

NRL FACT BOOK ★ December 2004 ★ NAVAL RESEARCH LABORATORY

NRL FACT BOOK



“The Navy’s Corporate Laboratory”

The *NRL Fact Book* is a reference source for information about the Naval Research Laboratory (NRL). It is updated and a slightly revised version is placed on NRL's Web site (<http://www.nrl.navy.mil/>) annually. It is printed every other year. To provide additional information to the reader, a point of contact is listed for each activity.

NRL has a continuing need for physical scientists, mathematicians, engineers, and support personnel. Vacancies are filled without regard to age, race, creed, sex, or national origin. Information concerning current vacancies is furnished on request. Address all such inquiries to:

Human Resources Office
Personnel Operations Branch (Code 1810)
Naval Research Laboratory
Washington, DC 20375-5320

NRL's URL: <http://www.nrl.navy.mil/>

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NRL

**FACT
BOOK**

**NAVAL RESEARCH LABORATORY
WASHINGTON, DC 20375-5320**

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The Naval Research Laboratory is located in Washington, DC, on the east bank of the Potomac River.

The NRL Marine Meteorology Division is located in Monterey, California (NRL-MRY).

The Naval Research Laboratory Detachment is located at Stennis Space Center, Bay St. Louis, Mississippi (NRL-SSC).

Introduction to the Naval Research Laboratory

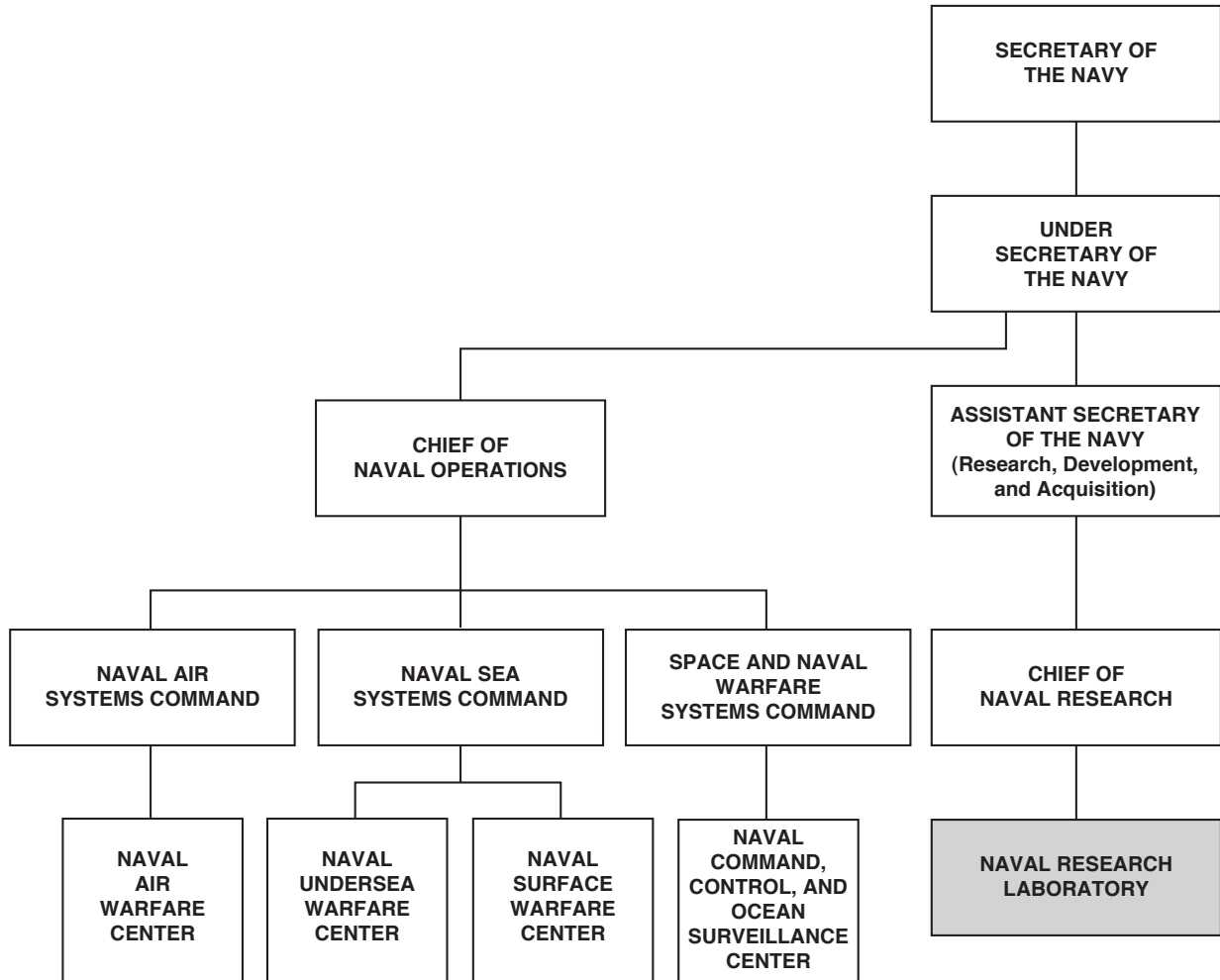
Mission

To conduct a broadly based multidisciplinary program of scientific research and advanced technological development directed toward maritime applications of new and improved materials, techniques, equipment, systems, and ocean, atmospheric, and space sciences and related technologies.

The Naval Research Laboratory

- Provides primary in-house research for the physical, engineering, space, and environmental sciences
- Provides broadly based exploratory and advanced development programs in response to identified and anticipated Navy and Marine Corps needs
- Provides broad multidisciplinary support to the Naval Warfare Centers
- Provides space and space systems technology development and support
- Assumes responsibility as the Navy's corporate laboratory







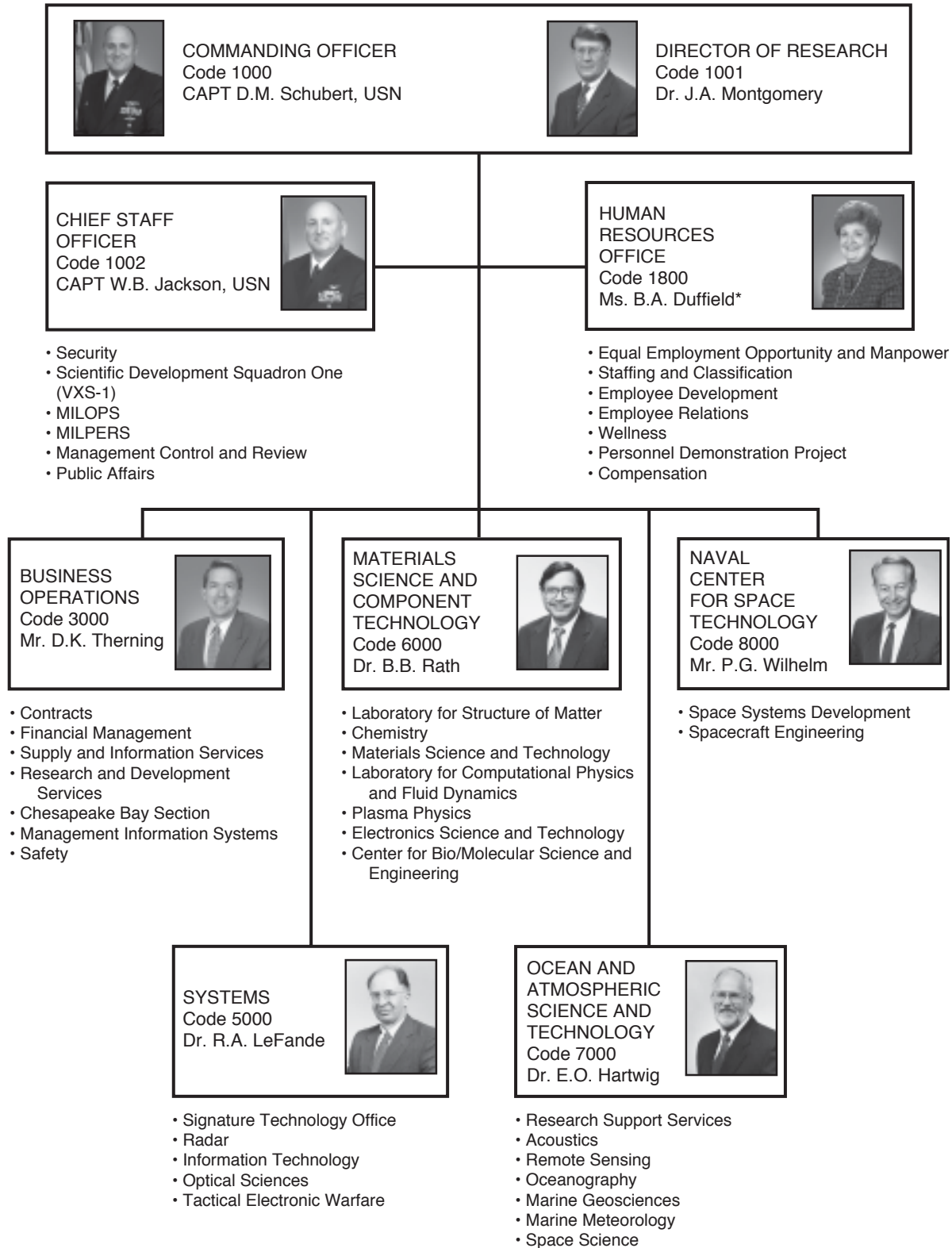
The Naval Research Laboratory in the Department of the Navy

The Naval Research Laboratory is the Department of the Navy's corporate laboratory; it is under the command of the Chief of Naval Research. As the corporate laboratory of the Navy, NRL is the principal in-house component in the Office of Naval Research's (ONR) effort to meet its science and technology responsibilities.

NRL has had a long and fruitful relationship with industry as a collaborator, contractor, and most recently in Cooperative Research and Development Agreements (CRADAs). NRL values this linkage and intends for it to continue to develop.

NRL is an important link in the Navy Research, Development, and Acquisition (RD&A) chain. Through NRL, the Navy has direct ties with sources of fundamental ideas in industry and the academic community throughout the world and provides an effective coupling point to the R&D chain for ONR.

NRL Functional Organization



*Acting

Current Research

The following areas represent broad fields of NRL research. Under each, more specific topics that are being investigated for the benefit of the Navy and other sponsoring organizations are listed. Some details of this work are given in the *NRL Review*, published annually. More specific details are published in reports on individual projects provided to sponsors and/or presented as papers for professional societies or their journals.

Advanced Radio, Optical, and IR Sensors

- Advanced optical sensors
- EM/EO/meteorological/oceanographic sensors
- Satellite meteorology
- Precise space tracking
- Radio/infrared astronomy
- Infrared sensors and phenomenology
- UV sensors and middle atmosphere research
- Image processing
- VLBI/astrometry
- Optical interferometry
- Imaging spectrometry
- Liquid crystal technology

Computer Science and Artificial Intelligence

- Standard computer hardware, development environments, operating systems, and run-time support software
- Methods of specifying, developing, documenting, and maintaining software
- Human-computer interaction
- Intelligent systems for resource allocation, signal identification, operational planning, target classification, and robotics
- Parallel scientific libraries
- Algorithms for massively parallel systems
- Digital progressive HDTV for scientific visualization
- Adaptive systems: software and devices
- Advanced computer networking
- Simulation management software for networked high performance computers
- Interactive 3-D visualization tools and applications
- Distributed modeling and simulation (e.g., HLA, and FOM development)
- Real-time parallel processing
- Scalable, parallel computing
- Processing graph method for parallel processing
- Teraflop scalable shared memory, massively parallel computer architectures

Directed Energy Technology

- High-energy lasers
- Laser propagation
- Solid-state and fiber lasers
- High-power microwave sources
- RAM accelerators
- Pulse detonation engines
- Charged-particle devices

- Pulse power
- DE effects

Electronic Electro-optical Device Technology

- Integrated optics
- Radiation-hardened electronics
- Nanotechnology
- Microelectronics
- Microwave and MM wave technology
- Hydrogen masers for GPS
- Aperture syntheses
- Electric field coupling
- Vacuum electronics
- Focal plane arrays
- Infrared sensors
- Radiation effects and satellite survivability
- Molecular engineering

Electronic Warfare

- EW/C2W/IW systems and technology
- COMINT/SIGINT technology
- EW decision aids and planning/control systems
- Intercept receivers, signal processing, and identification systems
- Passive direction finders
- Decoys and offboard CM (RF and IR)
- Expendable autonomous vehicles/UAVs
- Repeaters/jammers and EO/IR active countermeasures and techniques
- Platform signature measurement and management
- Threat and EW systems computer modeling and simulations
- Visualization
- Hardware-in-the-loop and flyable ASM simulators
- Missile warning infrared countermeasures
- RF environment simulators
- EO/IR multispectral/hyperspectral surveillance

Enhanced Maintainability, Reliability, and Survivability Technology

- Coatings
- Friction/wear reduction
- Water additives and cleaners
- Fire safety
- Laser hardening
- Satellite survivability
- Corrosion control
- Automation for reduced manning
- Radiation effects

- Mobility fuels
- Chemical and biological sensors
- Environmental compliance

Environmental Effects on Naval Systems

- Meteorological effects on communications
- Meteorological effects on weapons, sensors, and platform performance
- Air quality in confined spaces
- Electromagnetic background in space
- Solar and geomagnetic activity
- Magnetospheric and space plasma effects
- Nonlinear science
- Ionospheric behavior
- Oceanographic effects on weapons, sensors, and platforms
- EM, EO, and acoustic system performance/optimization
- Environmental hazard assessment
- Contaminant transport
- Biosensors
- Microbially induced corrosion

Imaging Research/Systems

- Remotely sensed signatures analysis
- Real-time signal and image processing algorithms/systems
- Image data compression methodology
- Image fusion
- Automatic target recognition
- Scene/sensor noise characterization
- Image enhancement/noise reduction
- Scene classification techniques
- Radar and laser imaging systems studies
- Coherent/incoherent imaging sensor exploitation
- Remote sensing simulation
- Hyperspectral imaging
- Microwave polarimetry

Information Technology

- High performance, all-optical networking
- Antijam communication links
- Next generation, signaled optical network architectures
- Integrated voice and data
- Information security (INFOSEC)
- Voice processing
- High performance computing
- High performance communications
- Requirement specification and analysis
- Real-time computing
- Wireless mobile networking
- Natural environments for distributed simulation
- Collaborative engineering environments
- Information filtering and fusion
- Integrated internet protocol (IP) and asynchronous transfer mode (ATM) multicasting
- Reliable multicasting
- Wireless networking with directional antennas

- Sensor networking
- Communication network simulation
- Bandwidth management (quality of service)
- High assurance software
- Distributed network-based battle management
- High performance computing supporting uniform and nonuniform memory access with single and multithreaded architectures
- Distributed, secure, and mobile information infrastructures
- Virtual engineering
- Simulation-based virtual reality
- Advanced distributed simulation
- High-end, progressive HDTV imagery processing and distribution
- Defensive information warfare
- Virtual reality/mobile augmented reality
- Motion adaptation and vestibular research
- 3-D multimodal interaction
- Model integration/physical, environmental, biological, psychological) for simulation
- Synthetic natural environments for distributed simulation
- Command decision support
- Data fusion

Marine Geosciences

- Marine seismology, including propagation and noise measurement
- Geoacoustic modeling in support of acoustic performance prediction
- Geomagnetic modeling in support of nonacoustic system performance prediction
- Static potential field measurement and analysis (gravity and magnetic) in support of navigation and geodesy
- Geotechnology/sediment dynamics affecting mine warfare and mine countermeasures
- Foreshore sediment transport
- Geospatial information, including advanced seafloor mapping, imaging systems, and innovative object-oriented digital mapping models, techniques, and databases

Materials

- Superconductivity
- Magnetism
- Biological materials
- Materials processing
- Advanced alloy systems
- Solid free-form fabrication
- Environmental effects
- Energetic materials/explosives
- Aerogels and underdense materials
- Nanoscale materials
- Nondestructive evaluation
- Ceramics and composite materials
- Thin film synthesis and processing
- Electronic and piezoelectric ceramics

- Thermoelectric materials
- Active materials and smart structures
- Computational material science
- Paints and coatings
- Flammability
- Chemical/biological materials
- Spintronic materials and half metals
- Biomimetic materials
- Multifunctional materials

Meteorology

- Global, theater, tactical-scale, and on-scene numerical weather prediction
- Data assimilation and physical initialization
- Atmospheric predictability and adaptive observations
- Adjoint applications
- Marine boundary layer characterization
- Air/sea interaction; process studies
- Coupled air/ocean/land model development
- Tropical cyclone forecasting aids
- Satellite data interpretation and application
- Aerosol transport modeling
- Meteorological applications of artificial intelligence and expert systems
- On-scene environmental support system development/nowcasting
- Tactical database development and applications
- Meteorological tactical decision aids
- Meteorological simulation and visualization

Ocean Acoustics

- Underwater acoustics, including propagation, noise, and reverberation
- Fiber-optic acoustic sensor development
- Deep ocean and shallow water environmental acoustic characterization
- Undersea warfare system performance modeling, unifying the environment, acoustics, and signal processing
- Target reflection, diffraction, and scattering
- Acoustic simulations
- Tactical decision aids
- Sonar transducers
- Dynamic ocean acoustic modeling

Oceanography

- Oceanographic instrumentation
- Open ocean, littoral, polar, and nearshore oceanographic forecasting
- Shallow water oceanographic effects on operations
- Modeling, sensors, and data fusion
- Bio-optical and fine-scale physical processes
- Oceanographic simulation and visualization
- Coastal scene generation
- Waves, tides, and surf prediction

- Coupled model development
- Coastal ocean characterization
- Oceanographic decision aids
- Global, theater, and tactical scale modeling
- Remote sensing of oceanographic parameters
- Satellite image analysis


Space Systems and Technology

- Space systems architectures and requirements
- Advanced payloads and optical communications
- Controllers, processors, signal processing, and VLSI
- Precision orbit estimation
- Onboard autonomous navigation
- Satellite ground station engineering and implementation
- Tactical communication systems
- Spacecraft antenna systems
- Launch and on-orbit support
- Precise Time and Time Interval (PTTI) technology
- Atomic-time/frequency standards/instrumentation
- Passive and active ranging techniques
- Design, fabrication, and testing of spacecraft and hardware
- Structural and thermal analysis
- Attitude determination and control systems
- Reaction control
- Propulsion systems
- Navigation, tracking, and orbit dynamics
- Spaceborne robotics applications

Surveillance and Sensor Technology

- Point defense technology
- Imaging radars
- Surveillance radars
- Multifunction RF systems
- High-power millimeter-wave radar
- Target classification/identification
- Airborne geophysical studies
- Fiber-optic sensor technology
- Undersea target detection/classification
- EO/IR multispectral/hyperspectral detection and classification
- Sonar transducers
- Electromagnetic sensors—gamma ray to rf wavelengths
- SQUID for magnetic field detection
- Low observables technology
- Ultrawideband technology
- Interferometric imagery
- Microsensor system
- Digital framing reconnaissance canvas
- Biologically based sensors
- Digital radars and processors

Undersea Technology

- Autonomous vehicles
- Bathymetric technology
- Anechoic coatings
- Acoustic holography
- Unmanned undersea vehicle dynamics
- Weapons launch 

Major Research Capabilities and Facilities

(Listed alphabetically by organizational unit)

Acoustics Division (Code 7100)

Large, sandy-bottom, holographic pool facility for investigating echo characteristics of underwater buried/near-bottom targets and sediment acoustics

Multichannel programmable acoustic signal processing system

Containerized data processing for acoustic array processing at remote sites and aboard ship

One million gallon, vibration-isolated underwater holographic/3-D laser vibrometer facility for studying structural acoustic phenomena for submarine, mine countermeasure, and torpedo systems

In-air structural acoustics facility with high spatial density nearfield acoustic holography and 3-D laser vibrometer measurements and processing systems for diagnosing large structures, including aircraft interiors and rocket payload fairings

High-powered sound source array

Moored acoustic array with satellite telemetry channels for measuring directional noise

Multiple-towed acoustic arrays with up to 144 acoustic channels for measuring directional noise

Twin underwater towers supporting sources and hydrophone arrays to measure high-frequency propagation, volume, and boundary scattering in shallow water

High-speed maneuverable towed body with MK-50 and synthetic aperture sonars to measure high-frequency boundary scattering and coherence

Tactical oceanography simulation laboratory

Digital acoustic buoy systems (DABS), which can autonomously record data from vertical and/or horizontal acoustic arrays, providing the capability to (1) make long-term ambient noise measurements uncontaminated by the noise of a nearby ship and (2) make single ship propagation measurements

Acoustic communications simulation laboratory

20-ft by 20-ft by 10-ft deep above-ground saltwater acoustic tank facility with environmental control and substantial optical access

Center for Bio/Molecular Science and Engineering (Code 6900)

Optical equipment

- Confocal fluorescent microscope
- CW fluorimeter and microscope
- Excimer laser projection exposure system
- Dektak surface profilometer
- Optical and fluorescence microscopes
- Photon correlation spectrometer
- Picosecond dye laser system
- Raman spectrometers

Scanning and transmission electron microscope

SLM fluorimeter (visible through near IR)

Time resolved fluorimeter (nanosecond)

UV-visible absorption spectrophotometers

Analytical instruments

- Atomic force/scanning tunnelling microscope
- Capillary electrophoresis unit
- Contact angle goniometer
- Differential scanning calorimeter
- GC/MASS spectrometer
- DNA synthesizer; DNA sequencer
- HPLC
- Patch clamp microelectrodes
- Potentiometer for electrochemistry

General facilities

- Class 100 clean room
- Cold room for storage and preparation
- Controlled shelf temperature lyophilizer
- Silicon Graphics IRIS workstation
- Freeze-fracture apparatus
- High-speed ultracentrifuges
- Inert atmosphere dry box
- NMR
- FTIR
- Ellipsometer
- Titration calorimeter
- Differential scanning calorimeter

Chemistry Division (Code 6100)

Synthesis/processing facilities

- Paint formulation and coating
- Functional polymers/elastomers
- Langmuir-Blodgett film
- Surface cleaning
- Thin film deposition/etching with in-situ control

Marine Corrosion Facility (at Key West, Florida)

Characterization facilities

- General purpose chemical analysis
- Surface diagnostics
- Nanometer scale composition/structure/properties
- Magnetic resonance NDI
- Tribology
- Polymer structure/function

Special purpose capability

- Environmental monitoring/remediation
- Combustion and fire research
- Alternate and petroleum-derived fuels

Simulation/modeling

Synchrotron radiation beam lines (at NSLS, Brookhaven, NY)

Electronics Science and Technology Division (Code 6800)

Nano- and microelectronics characterization and processing facilities
Electron-beam nanowriter
High-resolution transmission electron microscope
Scanning tunneling microscopy and electro-optical analysis
Crystal growing facilities including bulk growth, molecular beam epitaxy, and organometallic chemical vapor deposition
Optical and electrical characterization of materials
Electronic testing and analysis facilities
Vacuum electronics engineering facility
Femtosecond laser facility

Information Technology Division (Code 5500)

Internet technology lab
JTF WARNET testbed
Mobile networking lab
General purpose equipment test lab
Brandywine antenna range
Pomomkey test range
CBD ship motion simulator
Signal analysis laboratory
Artificial intelligence computer network
HCI laboratory
Spatial audio and immersive simulation labs
Robotics laboratory
Fleet information system security technology laboratory
Virtual reality laboratory
DoD High Performance Computing Modernization Program (HPCMP) Distributed Center (DC)
High-speed ATM network (backbone and to the desktop)
ATDnet Washington area POP for high performance, multigigabit optical streams
Distributed file systems with authentication (Andrew File System / Multi-Resident Andrew File System (AFS/MRAFS))
Labwide network, NICENET, providing computer communications, video services, and gateways to networks and computer systems worldwide
Satellite dishes for video and data reception
File server/archiver system for central file storage of labwide data
Visualization laboratory
Navy engagement warfare assessment and virtual engineering (NEWAVE) research center
Distributed collaborative enterprise laboratory
Ruth H. Hooker Research Library

Institute for Nanoscience (Code 1100)

Clean Room (5000 sq ft), quiet (4000 sq ft), and ultra-quiet (1000 sq ft) laboratories
35 dB and 25 dB acoustically isolated zones

20 °C \pm 0.5 °C and 0.1°C controlled temperature zones

Vibration isolation

Vertical (mm, pp) <0.1 @ 70-500 Hz

Horizontal (mm, pp) <0.1 @ 70-500 Hz

Clean electrical power, free from SCR spikes and other interferences, and < \pm 10% voltage change

<0.5 mG at 60 Hz EMI

45 \pm 5% relative humidity

Class 100 clean room

Source of water meeting ASTM D5127 spec. Type E1.2

Clean Room Major Equipment

Monitoring system (toxic gas, hazmat, temperature)

Laminar flow wet benches for localized Class 1 / 10 ambient in clean room

Air purification unit to remove local organic contamination

DI water system

Wire bonder

E-beam writer with active vibration control system

Scanning electron microscope

Atomic force microscope

Metallurgical optical microscopes

Surface profiler

Mask aligners (2, 1, and 0.2 μ m)

Electron beam evaporation system

Low pressure chemical vapor deposition (LPCVD) system

Magnetron sputter deposition system

Reactive ion etching systems

Dual-beam focused ion beam workstation

Optical pattern generating system

Plasma-enhanced chemical vapor deposition (PECVD) system

Chlorine reactive ion etching system

Other Major Equipment

Transmission electron microscope

UHV multi-tip scanning tunneling microscope / nanomanipulator

Laboratory for Computational Physics and Fluid Dynamics (Code 6400)

Eighteen processor SGI Power Challenge

Eight processor SGI Origin 2000

Thirty-two processor SGI Origin 2000

Sixty-four processor SGI Origin 2000

Twenty-eight processor SGI Origin 3800

Sixty-four processor Alpha Cluster

Sixteen processor Athlon Cluster

256 processor Pentium 4 Cluster

Over sixty SGI, Apple, and Intel workstations

Three-fourths terabyte RAID disk storage systems

All computers and workstations have network connections to NICENET and ATDnet allowing

access to the NRL CCS facilities (including the DoD HPC resources) and many other computer resources both internal and external to NRL.

Laboratory for Structure of Matter (Code 6030)

Two area detector systems
One X-ray diffractometer
Four Silicon Graphics IRIS workstations
Protein and peptide chromatography
Atomic force microscope

Marine Geosciences Division (Code 7400)

Airborne gravimetry, magnetics, and topographic measurements suite coupled with differential GPS yielding position accuracies of < 1.0 meter
100 and 500 kHz sidescan sonar with 2-12 kHz chirp profiler and C_s magnetometer for seafloor characterization/imaging and shallow subbottom profiling
Deep-towed acoustic geophysical system operating at 220-1000 Hz characterizes subseafloor structure including gas clathrate accumulations and dissociation of methane hydrates
Acoustic seafloor classification system operating at 8-50 kHz provides underway, real-time prediction of sediment type and physical properties
Seafloor probes for measuring sediment pore water pressures, permeability, electrical resistivity, acoustic compressional and shear wave velocities and attenuations, and dynamic penetration resistance
100 and 300 kV transmission electron microscopes with environmental cell for study of sediment fabric, especially impact of organic matter
Object-oriented digital cartographic modeling techniques and databases with internet access
Map data formatting facility compresses map information onto compact disk-read only memory media for masters for use in aircraft digital moving map systems
Positioning, navigation, and timing laboratory
Comprehensive geotechnical and geoacoustics laboratory capability
Airborne electromagnetic (AEM) bathymetry system
Ocean bottom magnetometer system
3-D, multispectral, subbottom swath imaging system
Ocean bottom seismographs (OBS)
In-situ sediment acoustic measurement system (ISSAMS)
Instrumented mine shapes to measure hydrodynamics of free-fall in the water column, dynamics of deceleration in seafloor sediments, and rates and depths of scour burial
Hydrothermal plume imaging data acquisition and analysis system
Integrated digital databases analysis and

display system for bathymetric, meteorological, oceanographic, geoacoustic, and acoustic data
Stereometric video image processing system for use in foreshore morphology measurement
Sediment gas-content sampler
Acoustic tomographic probes for surf zone sands and gassy muds
Computed tomography (CT) system and real-time radiography unit with a 0-225 keV @ 0-1 mA micro-focus X-ray tube and a 225-mm image intensifier

Marine Meteorology Division (Code 7500)

Naval Integrated Tactical Environmental Subsystem (NITES) for fielding regional and shipboard METOC applications
AN/SMQ-11 shipboard antenna system for retrieving polar-orbiting satellite data
Geostationary satellite data direct readout and processing center
Supercomputer for numerical weather prediction systems development
Master Environmental Library (MEL) implemented on superworkstations for archiving and distributing real-time and historical atmosphere/ocean databases
Bergen Data Center for extensive file serving and research data backup/archival capability
Data visualization center for developing shipboard briefing tools, displaying observations and model output, and integrating meteorological parameters into tactical simulations
Classified radar and satellite data processing facility
Mobile Atmospheric Aerosol and Radiation Characterization Observatory

Materials Science and Technology Division (Code 6300)

Hot isostatic press
Cold isostatic press
High-energy, dispersive X-ray analytical system
Electron microprobe, SEM, SAM, and STEM systems
Quantitative metallography
Computer-controlled multiaxial loading and SCC measurement systems
Computer-aided, experimental stress analysis
Crystallite orientation distribution function (CODF)
Thermoelectric parametric measurement system
Class 1000 clean room; processing metallic film
Elevated temperature and structural characterization laboratory
Closed-loop, low- and high-cycle fatigue systems
Metallic film deposition systems
Magnetometry
Mossbauer spectroscopy
Cryogenic facilities
High-field magnets

High-resolution analytical electron microscope
 Isothermal heat treating facility
 Vacuum arc melting facility
 Vacuum induction melting facility
 3-MeV tandem Van de Graaff accelerator
 200-keV ion-implantation facility
 Microwave device test facility
 Excimer laser film deposition facility
 Bomen infrared spectrometer facility
 Diffuse light scattering facility
 Femtosecond laser facility
 Semiconductor assessment facility
 Surface characterization facility
 Accelerator mass spectrometry facility
 Carbon¹⁴ dating facility
 Laminated object manufacturing system
 Thermal analysis characterization suite (TGA /DSC /
 DMA /DEA / rheometer)
 Dielectric characterization facility
 Composites processing autoclave
 3D ESPI strain measurement system
 Biomechanical surrogate fabrication facility

Oceanography Division (Code 7300)

Towed sensor and advanced microstructure profiler
 systems for studying upper ocean fine and micro-
 structure
 Integrated absorption cavity and optical profiler
 systems for studying ocean optical characteristics
 Environmental scanning electron microscope and
 confocal laser scanning microscope for detailed
 studies of biocorrosion in naval materials
 Self-contained bottom-mounted upwardlooking
 acoustic profilers for measuring ocean variability
 Acoustic Doppler profiler for determining ocean cur-
 rents while underway
 Data visualization center for displaying ocean
 model output
 Remotely operated underwater vehicle (ROV)
 Bottom-mounted acoustic Doppler profilers
 Towed hyperspectral optical array
 SCI processing facility
 Satellite receiving stations for AVHRR, SeaWiFS, and
 DMSP ocean color processing facility

Optical Sciences Division (Code 5600)

Short-pulse excitation apparatus for kinetic mecha-
 nisms investigations
 IR laser facility for optical characterization of semicon-
 ductors
 Mobile, high-precision optical tracker
 Facilities for synthesis and characterization of optical
 glass compositions and for the fabrication of optical
 fibers
 Optical and digital image processing facilities
 Silica and IR fluoride/chalcogenide fiber fabrication
 facilities
 Facilities for fabricating and testing integrated optical
 devices

Optical probes laboratory to study viscoelastic,
 structural, and transport properties of molecu-
 lar systems
 Computer IR/EO technology/systems simulation
 center
 Laser-diode pumped solid-state lasers
 Field-qualified EO/IR measurement devices
 Focal plane array evaluation facility
 Mid-IR, low-phonon crystal growth facility
 Multispectral image processing facility
 Indoor IR test range
 NRL P-3 aircraft sensor pallet
 EO/IR high-resolution reconnaissance / surveil-
 lance sensors
 RF and laser data links
 Infrared countermeasure techniques laboratory
 Multi- and hyperspectral sensors and processing
 Environmental testing of fiber sensors (acoustic,
 magnetic, electric field, etc.)
 High-speed, high-power, photodetector charac-
 terization
 Communication link characterization to >100
 Gbps
 RF phase noise, noise figure, and network
 analysis
 Ultrahigh-speed A / O convertors

Plasma Physics Division (Code 6700)

Mercury, 6 MV, 360 kA, magnetically insulated
 inductive voltage adder
 Gamble II, 1 MV, 1 MA pulsed power generator
 HAWK, 1 MA inductive storage facility
 PHAROS III, two-beam neodymium-glass laser
 and target facility
 Table-Top Terawatt (T³) laser system
 Table-Top Ti: Sapphire Femtosecond Laser (TFL)
 system
 NIKE krypton fluoride laser facility
 Large volume space chamber (2 m × 7 m)
 Large-area plasma processing system
 Microwave facility for processing of advanced
 materials (2.45, 35, 94, and 60-120 GHz)
 ELECTRA, test bed for high-rep 5 Hz KrF laser

Radar Division (Code 5300)

Shipboard radar research and development test
 beds:
 AMRFC testbed
 Wideband digital beamforming testbed
 AN/SPS-49A(V)1
 Airborne research radar facility, including
 advanced profile high-resolution imaging radar
 and P-3 (1998) with APS-145 Group 2 and CEC
 High-power 94 GHz radar system
 Ultrahigh resolution radar system (microwave
 microscope)
 Radar signature calculation facility
 Electromagnetic numerical computation facility

- Compact range antenna measurement laboratory and nearfield scanner
- Space-time adaptive processing (STAP) laboratory
- Electronic computer-aided design facility
- Clutter research radar
- Jet engine modulation (JEM) laboratory
- Microwave and RF instrumentation laboratory
- Cryogenic microwave and RF measurement facility
- High-bandwidth, high-capacity data recording system

Remote Sensing Division (Code 7200)

- Polar ozone and aerosol monitor space sensor
- Ground-based stratospheric water-vapor monitoring system
- SAR processing facility
- SCI processing facility
- SEALAB
- SAIL
- Hyperspectral imaging, sensors, and processing
- Optical remote sensing calibration lab/ facility
- Navy prototype optical interferometer
- NRL/NRAO 74 MHz very large array
- Free surface hydrodynamics laboratory
- SSM/I processing facility
- STEMS system
- Volume imaging lidar system
- Aerosol and field measurement facility
- Airborne polarimetric microwave imaging radiometer (APMIR)
- NRL RP-3A aircraft sensors
 - Airborne lidar
 - MMW imagers
 - DMSP SSM/I simulator
 - PRT-5 IR radiometer
 - Imaging real-aperture radar (RAR)
 - Flight-level meteorological sensors
 - Hyperspectral sensor systems (PHILLS)
 - Ultrawideband SAR (NUSAR)

Research and Development Services Division (Code 3500)

- Military construction
- Research support engineering
- Planning
- Full range of facility contracting, including construction, architect/engineering services, facilities support, and reserved parking
- Transportation
- Telephone services
- Maintenance and repair of buildings, grounds, and communication and alarm systems
- Shops for machining, sheet metal, welding, and plating

Spacecraft Engineering Department (Code 8200)

- Chambers:
 - Thermal-vacuum
 - Acoustic reverberation

Facilities:

- Spacecraft high-reliability electronic and electrical production facility
- Spacecraft electronic systems integration and test facility
- Radio frequency (RF) system development facility
- RF microcircuit fabrication cleanroom facility
- Large tapered horn RF anechoic chamber facility
- Frequency Sources Laboratory
- Shock and vibration test
- Cleanrooms
- Spacecraft-fabrication and assembly
- Fuels testing
- Autoclave
- Robotics engineering and controls laboratory
- Dynamic motion simulator
- CAD/CAM
- Propulsion system welding
- Static loads test
- Star tracker characterization
- Spacecraft spin balance
- Modal analysis
- Computational astrodynamic simulation and visualization


Space Science Division (Code 7600)

- E.O. Hulburt Center for Space Research
- Development and test facilities for spaceborne instruments to perform astrophysical, solar, high-atmospheric, and space-environment sensing
- Cleanroom facilities
- Extensive computer-assisted data manipulation and interpretive capability for space-data imaging and modeling
- Backgrounds Center of Expertise (BCoE)
- Ballistic Missile Defense Organization (BMDO)
- Synthetic Scene Generation Model (SSGM)
- Backgrounds Data Center for analysis of BMDO-relevant natural backgrounds
- Special Sensor Ultraviolet Limb Imager (SSULI) calibration facility
- Ultraviolet remote sensing data center
- Low-temperature laboratory
- Gamma Ray Observatory (OSSE) operations and data analysis center
- Gamma ray and X-ray imaging facility
- Solar instrument test facility
- Solar Ultraviolet Spectral Irradiance Monitor (SUSIM) operations and data analysis center
- Large Angle Spectrometric Coronagraph (LASCO) operation and data analysis
- Extreme-ultraviolet imaging telescope (EIT)
- Middle Atmosphere High Resolution Spectrograph Investigation (MAHRSI) to measure OH and NO in middle atmosphere
- Very-low background facility for measurement of ultrasmall quantities of radioactive isotopes

Space Systems Development Department (Code 8100)

Payload test facility and processor development laboratory
Laser communications and electro-optics laboratories
Tactical Technology Development Laboratory (TTDL)
Precision oscillator (clock) test facility
RF payload development laboratory with anechoic chamber
Precision high-frequency RF compact range anechoic chamber facility
Transportable ground station development, assembly, and test facility
Multiplatform FPGA / ASIC / VLSI development laboratory
Satellite telemetry, tracking, and control facilities
Pomomkey field site/large antenna, space communications, and research facility
Midway Research Center/space communications and research facility
Optical telescope facility

Tactical Electronic Warfare Division (Code 5700)

Mobile infrared signature measurement and simulation facility
Mobile ESM laboratory
Hybrid RF/IR missile-seeker simulation facility
Central target simulation facility for developing, testing, and evaluating EW systems and techniques, using real-time, hardware-in-the-loop models
RF simulation laboratory and signal simulators
Radar cross-section measurement facility (at CBD)
Search radar ECM simulator
Advanced tactical EW environment simulator
Electronic warfare coordination test bed
Scale-model analysis facility
Wind tunnel for performance measurements of low Reynolds number vehicles
Optical integration laboratory
Tempest signal-processing laboratory
Simulated ship-mast facility
Secure supercomputer facility
Vehicle development laboratory
Visualization laboratory 

NRL Sites and Facilities

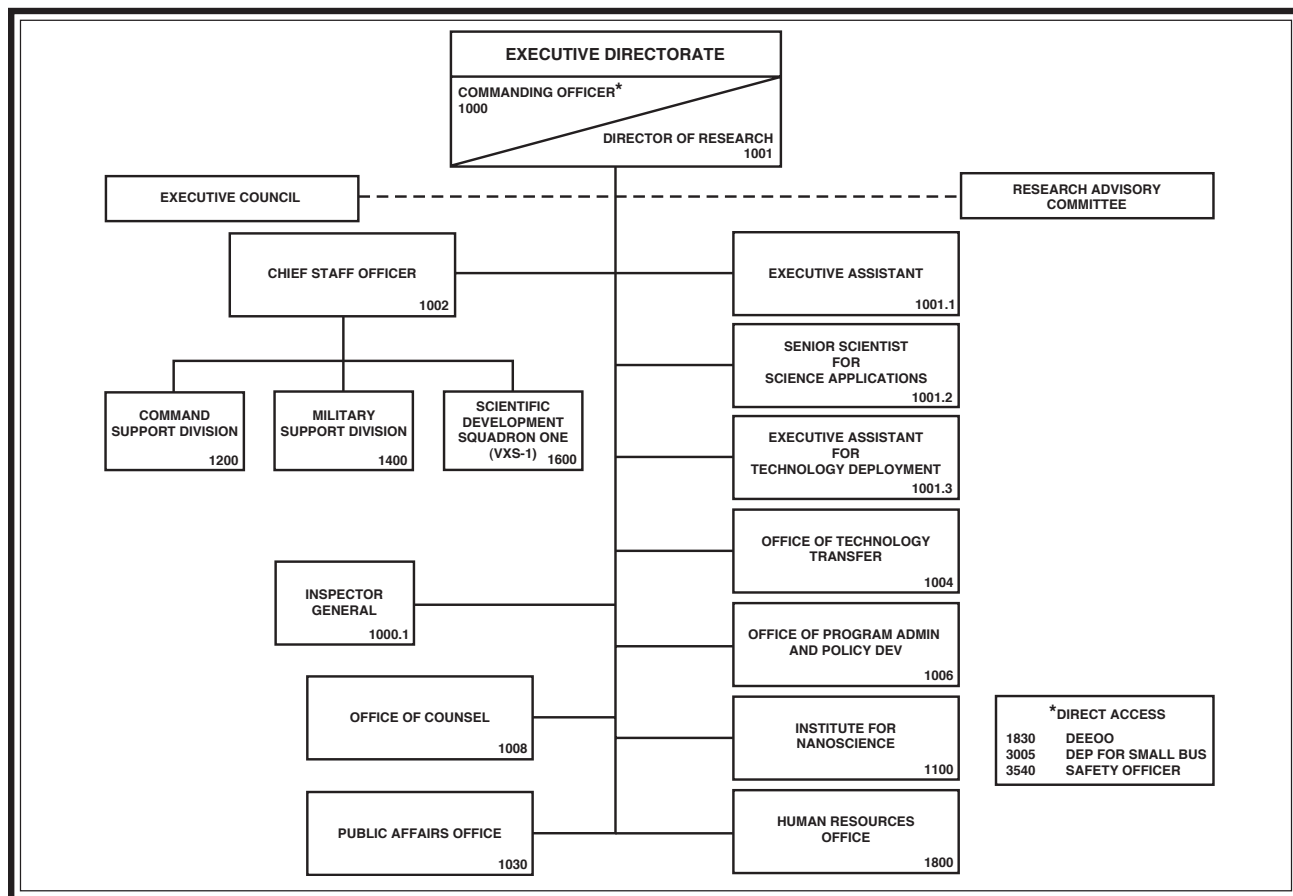
SITE	ACREAGE		BUILDINGS/ STRUCTURES
	LAND OWNED/LEASED	EASEMENT/ LICENSE- PERMIT	
District of Columbia NRL and Artificial Intelligence Center at Bolling AFB	131/10	0/10.13	85/26
Virginia Midway Research Center Quantico	162/0	0/0	6/5
Maryland NRL Scientific Development Squadron One (VXS-1), NAS Patuxent River*	Tenant		
Chesapeake Bay Section and Dock Facility Chesapeake Beach*	157/0	.6/.02	49/83
Multiple Research Site Tilghman Island*	2/0	0/0	3/3
Radio Antenna Range USAF Receiver Site Brandywine*	0/0	0/0	1/0
Free Space Antenna Range Pomomkey*	55/0	29.4/0	10/10
Blossom Point Satellite Tracking and Command Station Blossom Point	0/0	0/306	20/23
Florida Marine Corrosion Facility Key West	Tenant		
California NRL Monterey Monterey*	Tenant		
Mississippi Stennis Space Center Bay St. Louis*	Tenant		
Alabama Ex-USS <i>Shadwell</i> (LSD-15) Mobile Bay	Tenant		
	Decommissioned 457-ft vessel used for fire research		

PROPERTY

Land:		Buildings:		Replacement Costs:	
Owned	507 acres	RDT&E	3,062,303 ft ²	Real property – current	
Leased	10 acres	Administrative	194,992 ft ²	Replacement value	\$780.3 million
		Other	253,309 ft ²	Equipment	\$186.7 million

*See maps in the General Information section (page 133).

**Executive
Directorate**



Name	Key Personnel Title	Code
CAPT D.M. Schubert, USN	Commanding Officer	1000
Dr. J.A. Montgomery	Director of Research	1001
	Executive Assistant	1001.1
	Senior Scientist for Science Applications	1001.2
	Executive Assistant for Technology Deployment	1001.3
CAPT W.B. Jackson, USN	Chief Staff Officer / Inspector General	1002 / 1000.1
CAPT W.B. Jackson, USN	Head, Command Support Division	1200
	Deputy Head, Command Support Division / Deputy Inspector General	1000.11
	Command Management Review	1000.12
	Head, Office of Technology Transfer	1004
	Head, Office of Program Administration and Policy Development	1006
	Head, Office of Counsel	1008
Mr. R.L. Thompson	Head, Public Affairs Branch	1030
	°Director, Institute for Nanoscience	1100
CDR G.T. Salitsky, USN	Head, Military Support Division	1400
CDR G.T. Salitsky, USN**	Commanding Officer, Scientific Development Squadron One (VXS-1)	1600
	**Director, Human Resources Office	1800
	Deputy Equal Employment Opportunity Officer	1830
	Deputy for Small Business	3005
	Head, Safety Branch	3540

°Additional duty

**Acting

EXECUTIVE DIRECTORATE

Code 1000 and Code 1001

The Commanding Officer (Code 1000) and the Director of Research (Code 1001) share executive responsibility for the management of the Naval Research Laboratory. In accordance with Navy requirements, the Commanding Officer is responsible for the overall management of the Laboratory and exercises the usual functions of command including compliance with legal and regulatory requirements, liaison with other military activities, as well as the general supervision of the quality, timeliness, and effectiveness of the technical work and of the support services.

The Commanding Officer delegates line authority and assigns responsibility to the Director of Research for the technical program, its planning, conduct, and staffing; evaluation of the technical competence of personnel; liaison with the scientific community; selection of subordinate technical personnel; exchange of technical information; and the effective execution of the NRL mission.

Within the limits of Navy regulations, the Commanding Officer and the Director of Research share authority and responsibility for the internal management of the Laboratory. The Commanding Officer retains all authority and responsibility specifically assigned to him by higher authority.

The mission of the Laboratory is carried out by three science and technology directorates and the Naval Center for Space Technology, supported by the Business Operations Directorate and the Executive Directorate. In addition, the Laboratory's operating staffs provide assistance in their special fields to the Commanding Officer and to the Director of Research. The operating staffs are listed on the following pages of this publication.

Commanding Officer

Captain David M. Schubert, USN, assumed the duties as Naval Research Laboratory's (NRL) thirty-fourth Commanding Officer on May 31, 2002. He directs the research efforts of over 1,500 NRL scientists and engineers who conduct a broadly-based multidisciplinary program of scientific research and advanced technological development in the areas of materials science, systems, ocean and atmospheric sciences, and space sciences for the U.S. Navy, U.S. Marine Corps, and other federal agencies. Prior to reporting to the Naval Research Laboratory, Captain Schubert served as the Assistant Chief of Naval Research, where he was instrumental in establishing the Office of Naval Research's Future Naval Capabilities program, in promoting interaction between the technology and acquisition communities, and in finding science and technology solutions to current fleet problems.

Captain Schubert began his career at the United States Naval Academy, where he was a Trident Scholar and 1977 honors graduate earning a Bachelor of Science degree in Physics. Immediately following his commissioning as a Naval officer and while awaiting orders for nuclear power and submarine training, he reported to the Naval Research Laboratory, where he participated in a summer internship program testing thin line acoustic arrays.

Upon completion of nuclear power and submarine training, he reported to USS HAMMERHEAD (SSN 663) March 1979, where he served as Communications Officer, Damage Control Assistant, and Operations Officer. During this period, the ship deployed to the Mediterranean Sea, the North Atlantic, and the Indian Ocean, and earned two Battle Efficiency "E" awards.

From April 1982 to March 1984, Captain Schubert served as an instructor at Nuclear Power School in Orlando, Florida. He next served as the Chief Engineer of USS CHICAGO (SSN 721) during the ship's initial construction and shakedown period. In 1988 he was selected for the MIT/Woods Hole Joint Oceanography program, where he received a Masters Degree in Physical Oceanography.

In October 1990, Captain Schubert reported as Executive Officer on USS STONEWALL JACKSON (SSBN 634) (GOLD) where he completed three strategic deterrent patrols and earned a third Battle "E" award. From August 1992 to August 1994, he served on the Joint Staff (J3) as Operations Officer for the National Military Command Center.

Captain Schubert returned to USS CHICAGO as her Commanding Officer from May 1995 to July 1997. During his tour, the submarine deployed to the Arabian Gulf with the USS INDEPENDENCE Carrier Battle Group. CHICAGO was also the first submarine to control a Predator unmanned aerial vehicle during an exercise off Southern California in June 1996.

From August 1997 to July 1999, Captain Schubert served as the Assistant for Plans, Liaison and Assessments for the Submarine Warfare Division of the Navy Staff. He then moved to COMSUBLANT as the Assistant Chief of Staff for Warfare Requirements, Planning and Assessments. In these assignments, Captain Schubert was instrumental both in firmly establishing the current need for submarines, and for developing the vision for the Navy's future in undersea warfare.

Captain Schubert's awards include the Legion of Merit with Gold Star (second award), the Defense Meritorious Service Medal, the Meritorious Service Medal, the Navy and Marine Corps Commendation Medal, and the Navy and Marine Corps Achievement Medal, and various campaign and theater service medals.



Director of Research

Dr. John A. Montgomery received his Bachelor of Science degree in Physics from North Texas State University in 1967 and his Masters degree, also in Physics, in 1969. He received his PhD in Physics from the Catholic University of America in 1982. Dr. Montgomery is presently the Director of Research at the Naval Research Laboratory, where he oversees research and development expenditures of approximately \$800 million per year.

Dr. Montgomery joined the Naval Research Laboratory (NRL) in 1968 as a research physicist in the Advanced Techniques Branch of the Electronic Warfare Division, where he conducted research on a wide range of Electronic Warfare (EW) topics. In 1980, he was selected to head the Off-Board Countermeasures Branch. In 1985, he was appointed to the Senior Executive Service and was selected as Superintendent of the Tactical Electronic Warfare Division. He has been responsible for numerous systems that have been developed/approved for operational use by the Navy and other services. He has had great impact through the application of advanced technologies to solve unusual or severe operational deficiencies noted during world crises, most recently in the Persian Gulf, the Kosovo campaign, in Afghanistan, and for Homeland Defense.

Dr. Montgomery received the Department of Defense Distinguished Civilian Service Award in 2001. He was recognized by the Department of the Navy Distinguished Civilian Service Award in 1999 and by the Department of the Navy Meritorious Civilian Service Award in 1986. As a member of the Senior Executive Service, he received the Presidential Rank of Distinguished Executive award in 1991, and the Presidential Rank of Meritorious Executive award in 1988, and again in 1999. He also received the 1997 Dr. Arthur E. Bisson Prize for Naval Technology Achievement, awarded by the Chief of Naval Research in 1998. Further, he has received the Association of Old Crows (Electronic Defense Association) Joint Services Award in 1993. He was an NRL Edison Scholar, and is a member of Sigma Xi. He has served as the U.S. National Leader of The Technical Cooperation Program's multinational Group on Electronic Warfare since 1987, and served as its Executive Chairman.



Executive Council



The Executive Council consists of executive, management, and administrative personnel. Executive Council members include:

- Commanding Officer, Chairperson
- Director of Research
- Associate Directors of Research
- Chief Staff Officer
- Director, Naval Center for Space Technology
- Heads of Divisions
- Head, Laboratory for Structure of Matter
- Head, Laboratory for Computational Physics and Fluid Dynamics
- Head, Center for Bio/Molecular Science and Engineering
- Director, Human Resources Office
- Public Affairs Officer
- Deputy Equal Employment Opportunity Officer
- Head, Office of Program Administration and Policy Development
- Safety Officer
- Head, Office of Counsel
- Head, Office of Technology Transfer

Research Advisory Committee



The Research Advisory Committee advises the Commanding Officer and the Director of Research on scientific programs and the administration of the Laboratory. The committee assists in planning the long-range scientific program, coordinating the scientific work, reviewing the budget, accepting or modifying problems, considering personnel actions, and initiating such studies as may be necessary or desirable. The membership consists of the following:

- Director of Research, Chairperson
- Commanding Officer
- Associate Directors of Research
- Chief Staff Officer (Observer)



CAPT W.B. JACKSON, USN

Chief Staff Officer/Inspector General Code 1002/1000.1/1200

The Chief Staff Officer serves as the Deputy to the Commanding Officer and acts for the Commanding Officer in his absence. The Command Support Division (Code 1200), the Military Support Division (Code 1400), and the Scientific Development Squadron One (VSX-1) (NAS Patuxent River, MD, Code 1600) report directly to the Chief Staff Officer. When directed, the Laboratory's Inspector General investigates, inspects, and/or inquires into matters that affect the operation and efficiency of NRL. These matters include but are not limited to: effectiveness, efficiency, and economy; management practices; and fraud and waste. He serves as principal advisor to the Commanding Officer on all inspection matters and audits and is the principal point of contact and liaison with all agencies outside NRL.



MR. R.L. THOMPSON

Public Affairs Officer Code 1030

The Public Affairs Officer (PAO) advises the Commanding Officer and Director of Research on public affairs matters, including external and internal relations, community outreach, and serves as the Commanding Officer's principal assistant in the area of public affairs. To do this, the PAO plans and directs a program of public information dissemination on official NRL activities. The PAO coordinates responses to requests from the news media and the public for unclassified information or materials dealing with the Laboratory, coordinates participation in community relations activities, and directs the NRL history and internal information programs. The PAO is also responsible for coordinating all actions within the Laboratory that respond to requirements of the Freedom of Information Act (FOIA).

Deputy Equal Employment Opportunity Officer Code 1830

The Deputy Equal Employment Opportunity Officer (DEEOO) is the EEO program manager and the advisor to the Commanding Officer on all EEO matters. The DEEOO manages the discrimination complaint process and directs the Laboratory's affirmative action plans and special emphasis programs (Federal Women's, Hispanic Employment, African American Employment, Asian-Pacific Islanders, American Indian Employment, Individuals with Disabilities, including Disabled Veterans). The DEEOO recruits quality candidates for those areas when underrepresentation exists. Duties also include reviewing, coordinating, and monitoring implementation of EEO policies and developing local guidance, directives, and implementation procedures for the EEO programs.

Office of Technology Transfer

Code 1004

Basic Responsibilities

The Office of Technology Transfer is responsible for coordinating NRL's implementation of the Federal Technology Transfer Act. The Office of Technology Transfer facilitates the transitioning of NRL's innovative technologies for use in products and services to benefit the public. Technology Transfer Office personnel draft Cooperative Research and Development Agreements (CRADAs) under which NRL scientists and engineers work together with industry, academia, state or local governments, or other Federal agencies to develop NRL technologies for government and/or commercial applications. The Technology Transfer Office is also responsible for negotiating patent licensing agreements (PLAs) whereby NRL grants licensees the right to use NRL technologies in products for commercial sale. In addition to promoting NRL technologies through CRADAs, PLAs, and educational marketing mechanisms, the Office of Technology Transfer serves as a resource for NRL scientists and engineers to assist them with all steps toward transitioning their technologies for government or commercial use.

Personnel: 6 full-time civilian; 1 part-time civilian

Key Personnel

Title	Code
Head, Technology Transfer	1004
Technology Transfer	1004
Technology Transfer	1004
Technology Transfer	1004

Point of contact: Code 1004, (202) 767-7229

Office of Program Administration and Policy Development

Code 1006

Basic Responsibilities

The Office of Program Administration and Policy Development provides managerial, technical, and administrative support to the Director of Research (DOR) in such areas as program and policy development, intra-Navy and inter-Service Science and Technology (S&T) program coordination; liaison with other Navy, DoD, and government activities on matters of mutual concern; and support to the Executive Directorate in planning and directing NRL's S&T (6.1, 6.2) program. Specific functions include: monitoring and providing background information on technical and policy matters that come under the purview of the DOR; representing NRL, ONR, and/or the Navy on tri-Service or DoD-wide coordination matters; performing special studies or chairing ad hoc study groups regarding program decisions or policy positions; performing special studies involving major NRL programs and resource issues; providing administrative support in the areas of personnel, budget, facilities, equipment, and security; providing executive management information and analyses for various aspects of the S&T program effort; coordinating VIP visits to NRL; managing the NRL directives system; administering the NRL response to Congressional requests; maintaining the NRL R&D achievements file; developing the S&T guidance for monitoring and reporting the NRL S&T program; administering NRL's various postdoctoral fellowship programs; and managing the Facility Modernization Program.

Personnel: 20 full-time civilian

Key Personnel

Title	Code
Head	1006
Head, Program Administration Staff	1006.1
Administrative Officer	1006.2
*Head, Management Information Staff	1006.3
Head, NRL Facilities Staff	1006.4
Head, Directives Staff	1006.5

Point of contact: Code 1006.2, (202) 767-3082

*Acting

Office of Counsel

Code 1008

Basic Responsibilities

The Office of Counsel is responsible for providing legal services to NRL's management in all areas of general, administrative, intellectual property, and technology transfer law. The Office reviews all procurement-related actions; reviews NRL scientific papers prior to publication; prepares patent applications and prosecutes the applications through the Patent and Trademark Office; defends against contract protests, other contract litigation, and personnel cases; and advises on other legal matters relating to technology transfer, personnel, fiscal, and environmental law.

NRL Counsel also serves as legal advisor to the Commanding Officer and Director of Research.

Personnel: 25 full-time civilian

Key Personnel

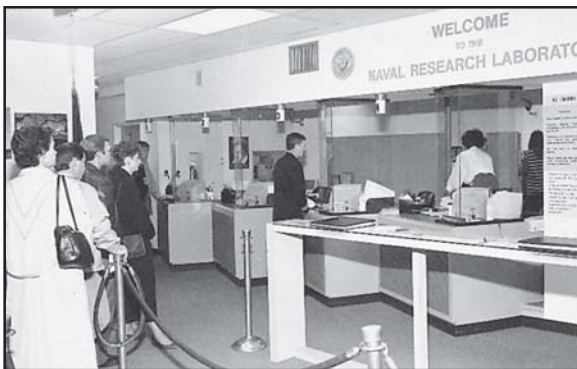
Title	Code
Head, Office of Counsel	1008
Associate Counsel/General Law	1008.1
Associate Counsel/Intellectual Property	1008.2
Associate Counsel/SSC Legal Matters	1008.3

Point of contact: Code 1008A, (202) 767-7606

Command Support Division

Code 1200 Staff Activity Areas

- Security
- Fire Protection



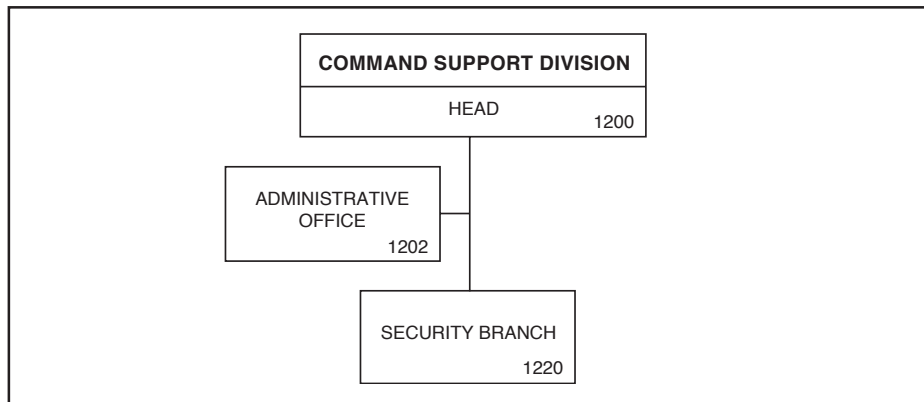
Incoming visitor's reception area



Security monitoring



CAPT W.B. JACKSON, USN



Basic Responsibilities

The Command Support Division provides civilian staff to the Commanding Officer and to the Director of Research. The Division is responsible for the Laboratory's physical, personnel, information, industrial, and IT security programs; communications service; and fire protection. It provides intelligence support and support for international cooperative agreements in technology. The Division also coordinates the Laboratory's Management Control Program and provides liaison and coordination for all audit and inspection teams. In addition, administrative/budget supervision over the Military Operations Branch and the Scientific Development Squadron One (VXS-1) is provided.

The Head of the Command Support Division is also the Inspector General. The Inspector General is responsible for day-to-day functioning of the office and its staff; program planning and execution, and providing interface with outside agencies concerning inspections and audits conducted or to be conducted by NRL. These include Inspector General representatives from ONR, Navy, DoD, and GAO.

Personnel: 36 full-time civilian

Key Personnel

Title	Code
Head	1200
Administrative Officer	1202
Head, Security Branch	1220
Head, Information Assurance Section	1221
Head, Physical Security Section	1222
Head, Special Security Services	1223
Head, Personnel Security Section	1224
Head, Force Protection/Command Investigator Section	1225
Head, Information Security Section	1226
Head, Communications Security Section	1227

Point of contact: Code 1202, (202) 767-3204

Military Support Division

Code 1400 Staff Activity Areas

- Operations
- Administrative Operations



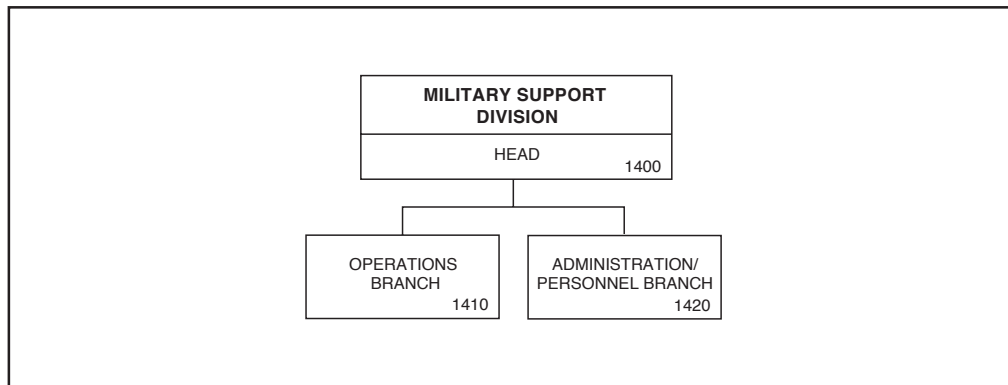
P-3 airborne research facility



Administration



CDR G.J. SALITSKY, USN



Basic Responsibilities

The Military Support Division provides military operational and administrative services to NRL.

The Operations Branch assists NRL Research Directorates in planning and executing project flight missions, develops deployment schedules and military operational and training objectives, and coordinates the Research Reserve Program within NRL.

The Military Administration Branch is responsible for the coordination and efficient functioning of all military administrative operations for NRL (including site detachments). These duties specifically include: personnel actions, maintenance of personnel records, performance evaluations, awards and training; advising the Chief Staff Officer on manpower matters and organization issues; and preparing and administering the military operational budget.

Personnel: 1 full-time civilian; 10 military

Key Personnel	
Title	Code
Head	1400
Assistant Military Operations Officer	1410
Assistant Military Operations Officer	1410
Assistant Military Operations Officer	1410
Military Administration and Personnel	1420

Point of contact: Code 1420B, (202) 767-0554

Scientific Development Squadron One (VXS-1)

Code 1600 Staff Activity Areas

- Operations
- Administrative Operations
- Aircraft Maintenance
- Safety/NATOPS



P-3 airborne research facility



Scientific Development Squadron One hangar



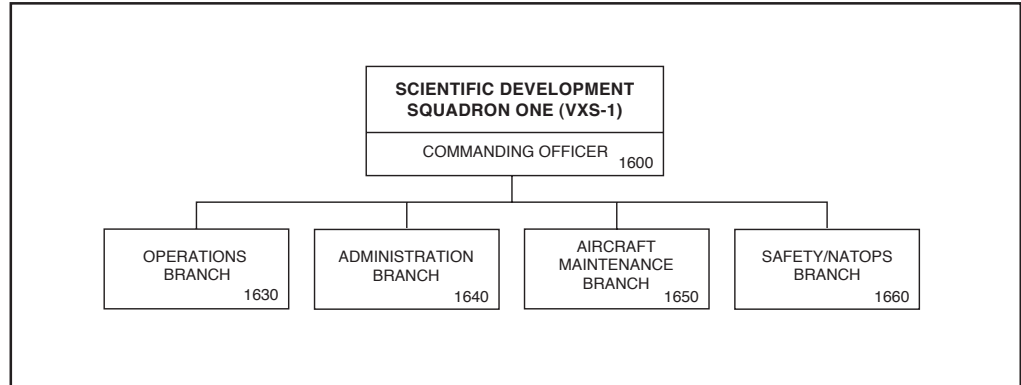
Administration



Aircraft maintenance



CDR G.J. SALITSKY, USN*



Basic Responsibilities

The Scientific Development Squadron One (VXS-1) located at NAS Patuxent River, Maryland, operates and maintains four uniquely configured P-3 Orion aircraft. The men and women of the squadron provide the Naval Research Laboratory with airborne research platforms, conducting flights worldwide in support of a wide spectrum of projects and experiments. These include magnetic variation mapping, hydroacoustic research, bathymetry, electronic countermeasures, gravity mapping, and radar research. The squadron annually logs 2,000 flight hours, and in its 41 years, the Scientific Development Squadron One (VXS-1) has amassed 63,000 hours of accident-free flying.

Personnel: 4 full-time civilian; 95 military

Key Personnel

Title	Code
*Commanding Officer	1600
Executive Officer	1601
Senior Enlisted Advisor	1600.2
Executive Secretary	1600.4
Operations Officer	1630
Administrative Officer	1640
Maintenance Officer	1650
Assistant Maintenance Officer	1650.1
Maintenance/Material Control Officer	1650.2
Head, Safety/NATOPS Branch	1660

Point of contact: Code 1600.4, (301) 342-3751; DSN 342-3751

*Acting

Human Resources Office

Code 1800 Staff Activity Areas

- Personnel Operations (Staffing, Classification, and Employee Development)
- Employee Relations
- Equal Employment Opportunity and Manpower
- Compensation, Reports, and Demonstration Project
- Information Technology and Reports



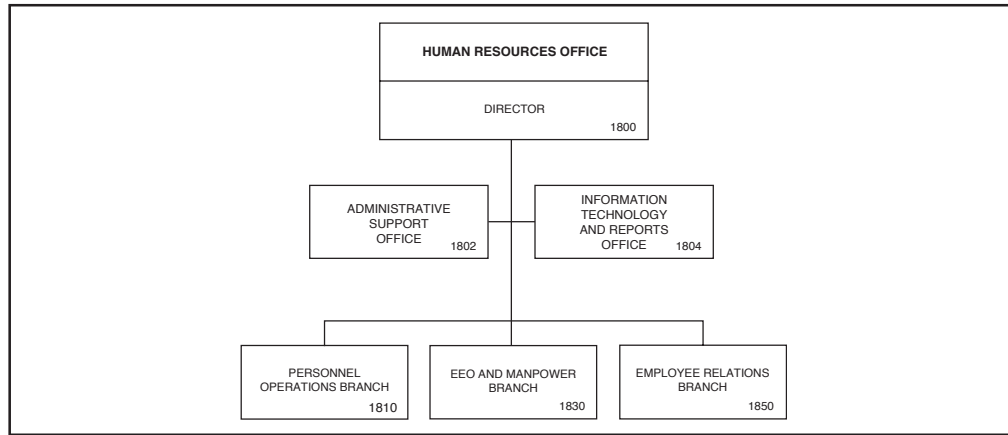
Employee Relations Branch



EEO and Manpower Branch



Personnel Operations Branch



Basic Responsibilities

The Human Resources Office (HRO) provides civilian personnel, manpower, and Equal Employment Opportunity (EEO) services to the Naval Research Laboratory. The Human Resources Program provides the full range of operating civilian personnel management in the staffing and placement, position classification, employee relations, labor relations, employee development, EEO functional areas, manpower management, and morale, welfare, and recreation programs.

The HRO at NRL's main site in Washington, DC, services approximately 3,000 employees as well as provides a centralized capability to perform various managerial, service, and advisory functions in support of field office operations. These include such items as issuance of policy and procedural directives; development, design, and maintenance of automated systems; and monitoring and evaluating product effectiveness to develop and maintain efficient, cost-effective, service-oriented methods.

Personnel: 30 full-time civilian

Key Personnel

Title	Code
*Director	1800
Administrative Officer	1802
*Head, Information Technology and Reports Branch	1804
Head, Personnel Operations Branch	1810
Head, Equal Employment Opportunity and Manpower Branch	1830
Head, Employee Relations Branch	1850

Point of contact: Code 1802, (202) 404-2797

*Acting

**Business
Operations
Directorate**

BUSINESS OPERATIONS DIRECTORATE

Code 3000

The Business Operations Directorate provides executive management, policy development, and program administration for business programs needed to support the activities of the scientific directorates. This support is in the areas of financial management, supply management, contracting, research and development services, and management information systems support.

Associate Director of Research for Business Operations



Mr. D.K. Therning was born in Modesto, California, on August 29, 1960. He graduated from Washington State University with a bachelor's degree in finance in 1983 and earned a master's degree in business administration from George Mason University in 1993.

Mr. Therning has accumulated extensive experience in the financial business management of research, development, test, and evaluation (RDT&E) activities within the Department of Navy (DoN) beginning at the Naval Weapons Center, China Lake, California, where he served as a budget analyst in the Public Works Department and then in the Weapons Department.

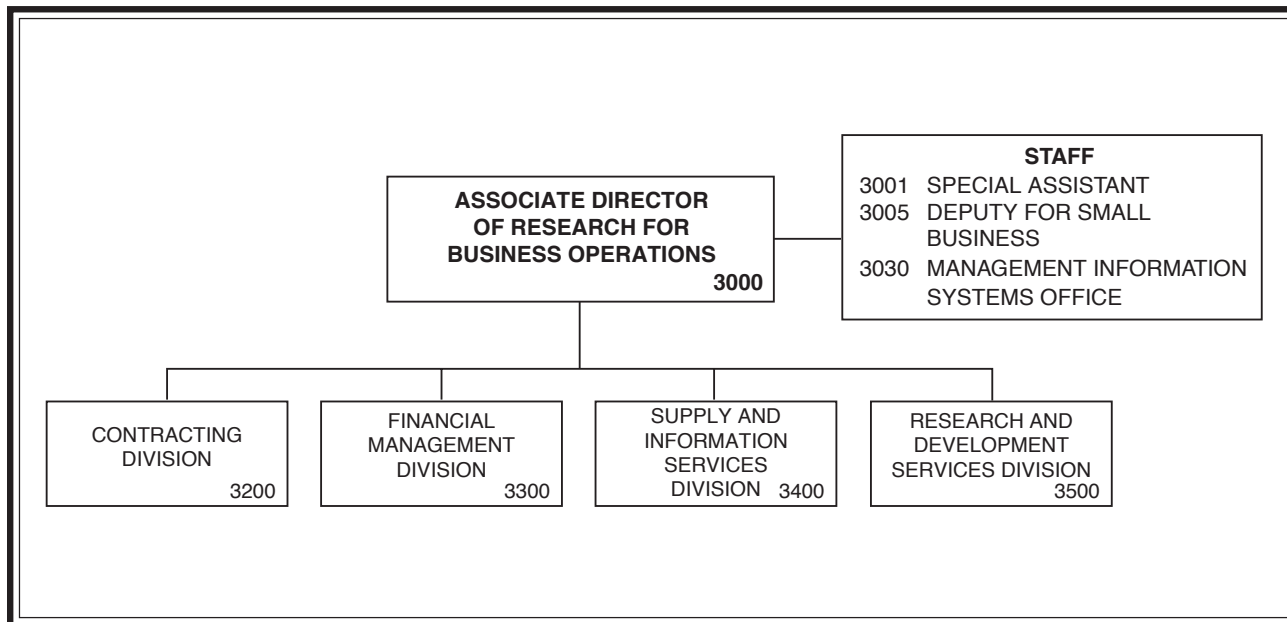
In 1984, he became the Financial Management Advisor to the Ordnance Systems Department. In 1985, under the auspices of the Naval Scientist Training and Exchange Program, he was selected for a one-year assignment in the Office of the Director of Naval Laboratories (DNL), Washington, DC. He remained on the DNL staff as a budget analyst until 1987, when he was appointed Budget Officer of the DNL's seven Navy Industrial Fund R&D laboratories.

As the DoN reorganized the R&D laboratories and T&E activities, Mr. Therning oversaw the financial reorganization of the DNL labs with other activities into the Naval warfare centers. Upon the disestablishment of DNL, Mr. Therning remained in the Space and Naval Warfare Systems Command as the Director of the Defense Business Operations Fund (DBOF) Resources Management Division, with collateral duty as the Financial Manager of the Naval Command, Control, and Ocean Surveillance Center (NCCOSC). During this time, he managed the conversion of nine appropriated fund engineering activities to DBOF and the financial consolidation of these activities with NCCOSC.

In 1995, Mr. Therning served as Head of the Revolving Funds Branch of the Office of the Assistant Secretary of the Navy (Financial Management and Controller), where he was responsible for the budget formulation and execution processes of all DoN DBOF activities, which includes the RDT&E activities, shipyards, aviation depots, ordnance centers, and supply centers.

Mr. Therning was appointed Head, Financial Management Division/Comptroller of NRL in July 1996. Since that time, his responsibilities have increased in the Business Operations Directorate. In October 1996, in addition to leading the Financial Management Division, he assumed responsibilities for the Management Information Systems office. In January 1999, as an additional duty to his role as Comptroller, Mr. Therning was appointed to the newly established position of Deputy Associate Director of Research for Business Operations to assist in the management and administration of the Business Operations Directorate.

Mr. Therning was Acting Associate Director of Research for Business Operations from April 1999 until March 2000, when he was appointed the Associate Director of Research for Business Operations.



Name	Key Personnel Title	Code
Mr. D.K. Therning	Associate Director of Research for Business Operations	3000
	Special Assistant	3001
	Deputy for Small Business	3005
	Head, Management Information Systems Office	3030
	Head, Contracting Division	3200
	Head, Financial Management Division	3300
	Head, Supply and Information Services Division	3400
	Director, Research and Development Services Division	3500

Point of contact: Code 3000A, (202) 404-7461

Contracting Division

Code 3200

- Advance Acquisition Planning
- Acquisition Strategies
- Acquisition Training
- Contract Negotiations
- Contractual Execution
- Contract Administration
- Acquisition Policy Interpretation and Implementation

Procurement Technician and Contracting Officer review contracts for closeout



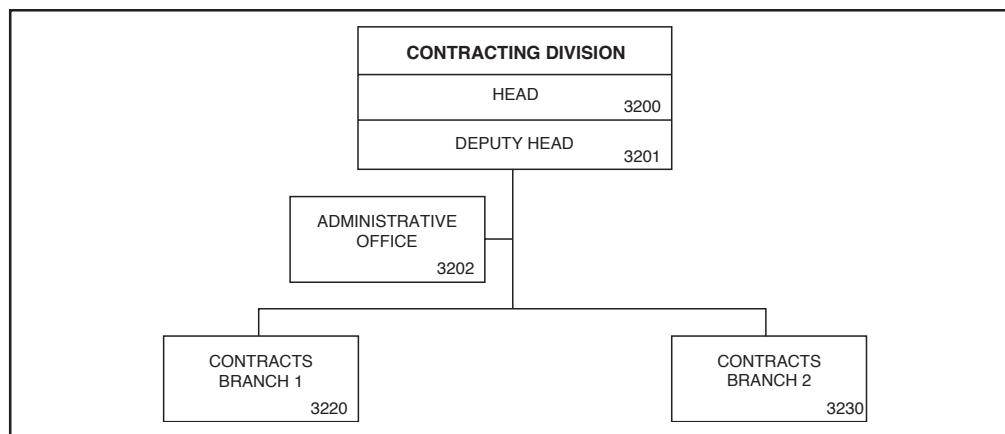
Contract Specialist consults with PIPS Hotline representative



Procurement Technician prepares contract documents in PIPS



Division Head conducts staff meeting



Basic Responsibilities

The Contracting Division is responsible for the acquisition of major research and development, materials, services, and facilities where the value is in excess of \$100,000. It also maintains liaison with the ONR Procurement Directorate on procurement matters involving NRL. Specific functions include: providing consultant and advisory services to NRL division personnel on acquisition strategy, contractual adequacy of specifications, and potential sources; reviewing procurement requests for accuracy and completeness; initiating and processing solicitations for procurement; awarding contracts; performing contract administration and post-award monitoring of contract terms and conditions, delivery, contract changes, patents, etc., and taking corrective actions as required; providing acquisition-related training to division personnel; and interpreting and implementing acquisition-related Federal Department of Defense and Navy regulations.

Personnel: 40 full-time civilian

Key Personnel

Title	Code
Head	3200
Deputy Head	3201
Administrative Officer	3202
Head, Contracts Branch 1	3220
Head, Contracts Branch 2	3230
Head, Contracts Section, SSC	3235

Point of contact: Code 3202, (202) 767-3749

Financial Management Division

Code 3300

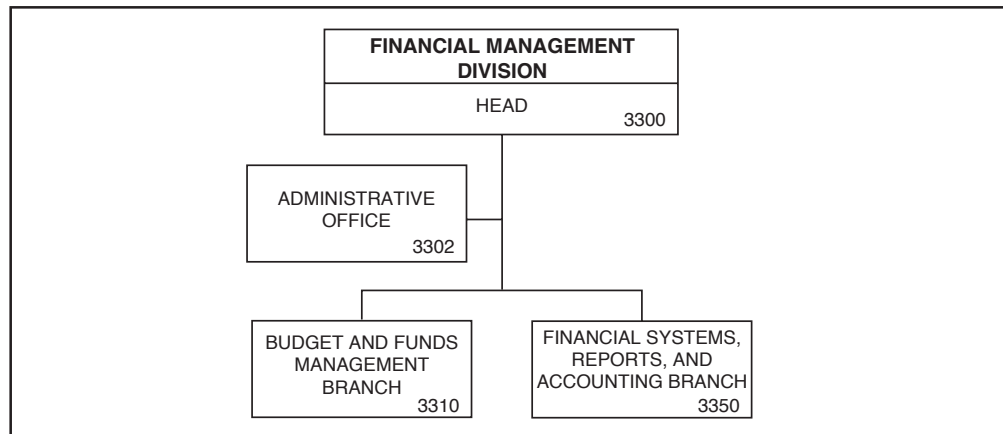
- Budget
- Reports and Statistics
- Accounting
- Travel Services
- Payroll Liaison



The Budget Branch prepares various financial analyses, reports, and studies in response to external data calls and/or management requests



The Financial Services Section coordinates efforts with DFAS to complete payment transactions related to NRL business, such as payroll and travel expenses



Basic Responsibilities

The Financial Management Division (FMD) develops, coordinates, and maintains an integrated system of financial management that provides the Comptroller, Commanding Officer, the Director of Research, and other officials of NRL the information and support needed to fulfill the financial and resource management aspects of their responsibilities. FMD translates the NRL program requirements into the financial plan, formulates the NRL budget, monitors and evaluates performance with the budget plan, and provides recommendations and advice to NRL management for corrective actions or strategic program adjustments. FMD maintains the accounting records of NRL's financial and related resources transactions and prepares reports, financial statements, and other documents in support of NRL management needs and/or to comply with external reporting requirements. FMD provides financial management guidance, policies, advice, and documented procedures to ensure that NRL operates in compliance with Navy and DoD regulations and with economy and efficiency. FMD coordinates efforts with the Defense Finance and Accounting Service (DFAS) to complete payment transactions related to NRL business (e.g., the payment of NRL personnel for payroll and travel expenses and the payment to NRL's contractors and vendors for goods and services purchased by NRL). Additionally, FMD develops, operates, and maintains automated business and management information systems supporting the lab-wide administrative and business processes, including financial management, procurement and contracting, stores and inventory, asset management, human resources, facilities, and security.

Personnel: 67 full-time civilian

Key Personnel

Title	Code
Head, Financial Management Division	3300
Administrative Officer	3302
Head, Budget and Funds Management Branch	3310
Head, Corporate Budget Unit	3310
Head, Internal Budget Unit	3310
Head, Financial Systems, Reports, and Accounting Branch	3350
Head, Cost Accounting Section	3351
Head, Contracts and Credit Cards Unit	3351.1
Head, Small Purchases and Miscellaneous Docs Unit	3351.2
Head, Financial Services Section	3352
Head, Payroll Services Unit	3352.1
Head, Travel Services Unit	3352.2
Head, Asset Management Unit	3352.3
Head, Accounting Systems and Reports	3353

Point of contact: Code 3302, (202) 767-2950

Supply and Information Services Division

Code 3400

- Purchasing
- Technical Information Services
- Customer Support and Program Management
- Material Control



Head of the Purchasing Branch reviews purchase order folder



Woodworkers prepare boxes for shipping



Mail clerks sort mail by directorate and file into bins by organizational codes. Mail is bundled and delivered once a day.

- Administrative Services
- Automated Inventory Management System
- Disposal and Storage
- Store Material Issues



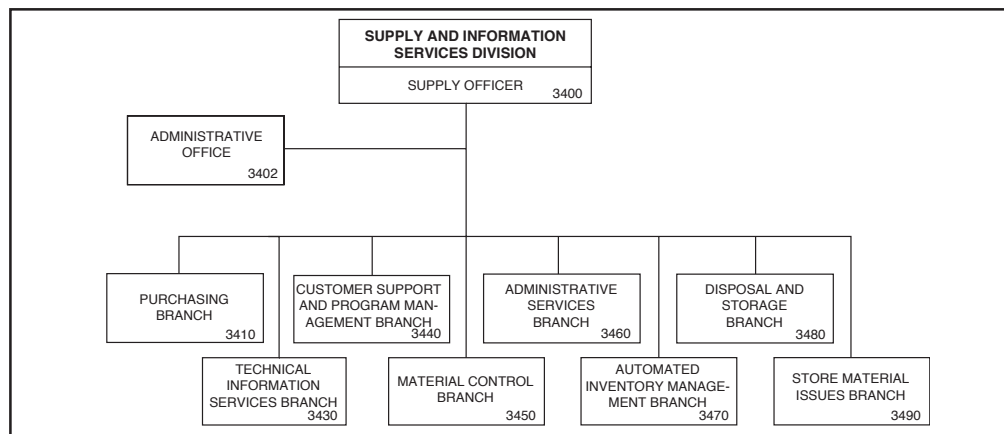
Customer and employee at the Supply store



Disposal and Storage in Building 49



The Publications staff reviews press sheets for one of NRL's publications



Basic Responsibilities

The Supply Division provides the Laboratory and its field activities with contracting, supply management, and logistics services. Specific functions include: procuring required equipment, material, and services; receiving, inspecting, storing, and delivering material and equipment; packing, shipping, and traffic management; surveying and disposing of excess and unusable property; operating various supply issue stores and performing stock inventories; providing technical and counseling services for the research directorates in the development of specifications for a complete procurement package; and obtaining and providing guidance in the performance stages of contractual services. Services also include publications, visual information, photography, editing, and mailroom services and correspondence management.

Personnel: 102 full-time civilian

Key Personnel

Title	Code
Supply Officer	3400
Administrative Officer	3402
Head, Purchasing Branch	3410
Head, Technical Information Services Branch	3430
Head, Customer Support and Program Management Branch	3440
Head, Material Control Branch	3450
Head, Administrative Services Branch	3460
Head, Automated Inventory Management Branch	3470
Head, Disposal and Storage Branch	3480
Head, Store Material Issues Branch	3490

Point of contact: Code 3402, (202) 767-3871

Research and Development Services Division

Code 3500

- Technical/Support Services
- Operations
- Shop Services
- Chesapeake Bay Section
- Customer Liaison
- Safety
- Environmental

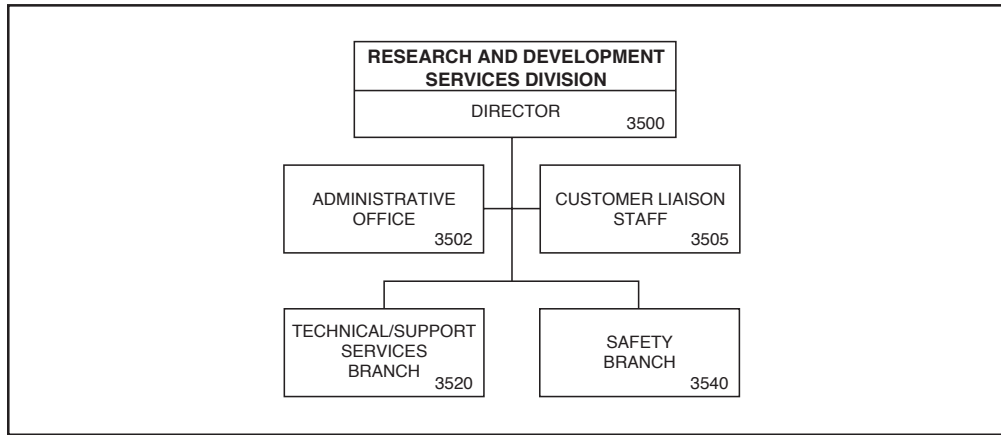


Service Desk – processing service calls

Telephone Office – processing service calls



Machine Shop – fabricating radar pedestal for shipboard operation



Basic Responsibilities

The Research and Development Services Division is responsible for the physical plant of the Naval Research Laboratory and subordinate field sites. The responsibilities include military construction, engineering, and coordination of construction; facility support services, planning, maintenance/repair/operation of all infrastructure systems; transportation; and occupational safety, health and industrial hygiene, and environmental safety.

The Division provides engineering and technical assistance to research divisions in the installation and operation of critical equipment in support of the research mission.

Personnel: 155 full-time civilian

Key Personnel

Title	Code
Director	3500
Administrative Officer	3502
Head, Customer Liaison Staff	3505
Head, Technical/Support Services Branch	3520
Head, Engineering Section	3521
Head, Chesapeake Bay Section	3522
Head, Shop Services Section	3523
Head, Production Control Section	3524
Head, Safety Branch	3540
Occupational Safety and Health/Industrial Hygiene	3541
Explosives Safety	3542
Health Physics	3544
Environmental	3546

Point of contact: Code 3502, (202) 767-2168

**Systems
Directorate**

SYSTEMS DIRECTORATE

Code 5000

The Systems Directorate applies the tools of basic research, concept exploration, and engineering development to expand operational capabilities and to provide materiel support to Fleet and Marine Corps missions. Emphasis is on technology, devices, systems, and know-how to acquire and move war-fighting information and to deny these capabilities to the enemy. Current activities include:

- New and improved radar systems to detect and identify ever smaller targets in the cluttered littoral environment;
- Optical sensors and related materials to extract elusive objects in complex scenes when both processing time and communications bandwidth are limited;
- Unique optics-based sensors for detection of biochemical warfare agents and pollutants, for monitoring structures, and for alternative sensors;
- Advanced electronic support measures techniques for signal detection and identification;
- Electronic warfare systems, techniques, and devices including quick-reaction capabilities;
- Innovative concepts and designs for reduced observables;
- Techniques and devices to disable and/or confuse enemy sensors and information systems;

- Small “intelligent”/autonomous land, sea, or air vehicles to carry sensors, communications relays, or jammers; and

- High-performance/high-assurance computers with right-the-first-time software and known security characteristics despite commercial off-the-shelf components and connections to public communications media.

Many of these efforts extend from investigations at the frontiers of science to the support of deployed systems in the field, which themselves provide direct feedback and inspiration for applied research and product improvement and/or for quests for new knowledge to expand the available alternatives.

In addition to its wide-ranging multidisciplinary research program, the Directorate provides support to the corporate laboratory in shared resources for high performance computing and networking, technical information collection and distribution, and in coordination of Laboratory-wide efforts in signature technology, counter-signature technology, Theater Missile Defense, and the Naval Science Assistance Program.

Associate Director of Research for Systems



Dr. R.A. LeFande was born on Staten Island, New York, on February 8, 1941. He attended the Brooklyn Technical High School and obtained his undergraduate degree in physics from the University of Rhode Island in 1962. After a brief tour as a telephone equipment engineer with Western Electric Company in New York City, he returned to academic pursuits, earning a Master's degree in physics from the Rutgers University in 1965.

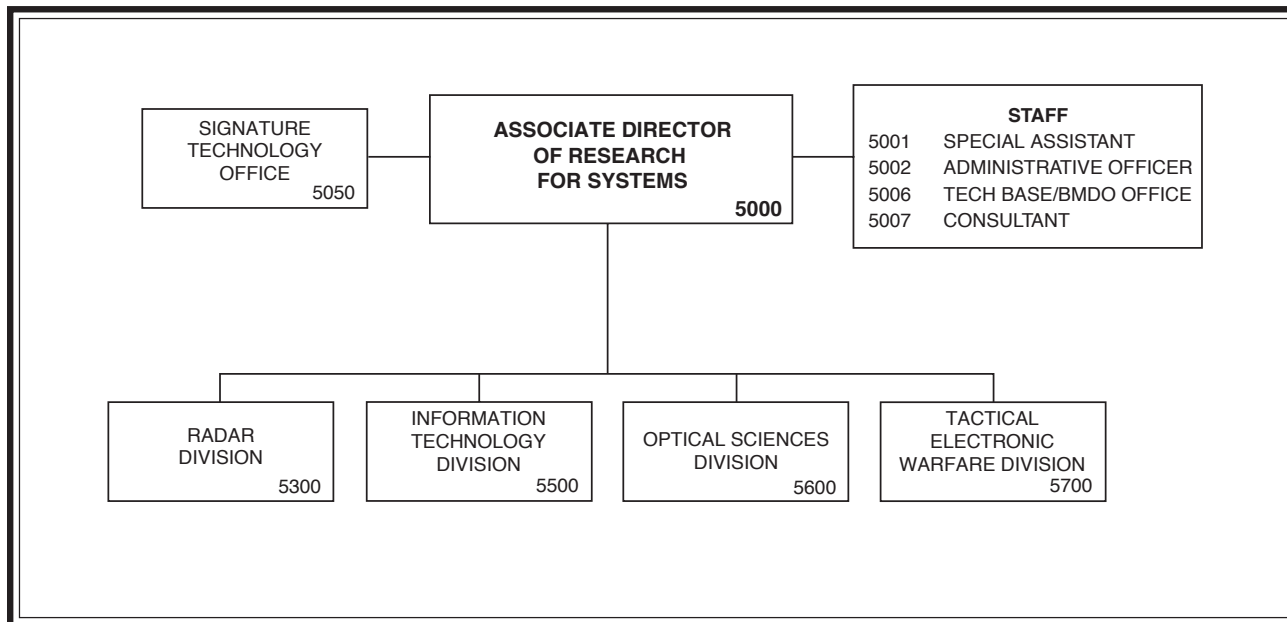
In July of 1965, Dr. LeFande joined the Naval Research Laboratory as a research physicist in the Satellite Communications Branch. He worked on a variety of projects related to the

design of waveforms for Naval applications, calibration of antennas and path losses by methods borrowed from radio astronomy, and on the design and acquisition of satellite communication terminals for shipboard and submarine use. By drawing on this work for a thesis topic, he obtained his Ph.D. from the University of Maryland in 1973, in the areas of astronomy and astrophysics.

In 1976, Dr. LeFande became Head of the Special Communications Branch where he nurtured and encouraged an NRL team of scientists and engineers in the development of satellite communications terminals that are now being deployed in the Fleet, and in establishing the scientific understanding and practical design principles that contributed to the selection of waveforms for MILSTAR and other systems.

From 1979 to 1981, Dr. LeFande was Technical Director and System Engineer of the Special Communication Project of the Naval Electronic Systems Command. He oversaw several research and acquisition programs related to submarine communications, which covered the spectrum from extremely low frequencies through optics and included the maintenance and operation of a worldwide network of radio transmitter facilities. After termination of the project and a brief tour as Deputy Director, Research and Technology Group, Dr. LeFande returned to NRL as Superintendent of the Aerospace Systems Division. Here he guided a diverse program of basic and applied research in Wide Area Surveillance Systems, Space Warfare, and in related areas of physical science, materials, and device technology. From 1983 to 1990, Dr. LeFande served as Associate Deputy Assistant Secretary of the Navy (C³I and Space), providing technical and philosophical advice to eight assistant and deputy assistant secretaries. In this capacity, he took a keen interest in the issues of acquisition management reform and of the appropriate roles and missions of the Laboratory and the other Centers in the acquisition process. During this tour, Dr. LeFande was selected as a Legis Fellow and served on the staff of Representative Byron for six months in 1989, working on a variety of issues and legislation related to the armed services, science and technology, foreign affairs, and other matters.

Dr. LeFande returned to the Laboratory in October 1990, where he served on the staff of the Director of Research. He was designated Acting Associate Director of Research in February 1991, and Associate Director of Research in February 1992.



Key Personnel

Name	Title	Code
Dr. R.A. LeFande	Associate Director of Research for Systems	5000
	Special Assistant	5001
	Administrative Officer	5002
	Head, Technology Base / Ballistic Missile Defense Office	5006
	Consultant	5007
Dr. D.W. Forester	Head, Signature Technology Office	5050
Mr. P.K. Hughes II	Superintendent, Radar Division	5300
Dr. J.D. McLean	Superintendent, Information Technology Division	5500
Dr. T.G. Giallorenzi	Superintendent, Optical Sciences Division	5600
Dr. F.J. Klemm	Superintendent, Tactical Electronic Warfare Division	5700

Point of contact: Code 5000A, (202) 767-3324

**Technology Base/Ballistic Missile Defense
(BMD) Office
Code 5006**

The Head of the Technology Base/BMD Office carries out program management activities pertaining to the Navy BMD, SBIR, critical technology, and other technology efforts. Mission activities include assurance of technical quality and program relevance, technology philosophy, orientation of the program to priority needs and transition opportunities, and overall coordination of NRL efforts. He is the Laboratory point of contact with the Program Offices for this work.

**Consultant
Code 5007**

The radar consultant provides expert advice, historical perspectives, analyses, and investigations in the field of radar, related systems, phenomenology, and applications to the Systems Directorate, NRL, the Navy, and other DoD organizations as requested.

Signature Technology Office

Code 5050



DR. D.W. FORESTER

- Electromagnetic Scattering Fundamentals
- Low Observables Materials
- Multidisciplinary Program Management
- Technology Transfer

Basic Responsibilities

The NRL Signature Technology Office (STO) performs research and manages/coordinates an integrated, comprehensive research and development program at NRL addressing all aspects of signature control and countersignature control as they apply to Navy weapons systems. The STO monitors and evaluates signature control technology development efforts within government and industry and facilitates the incorporation of advanced signature control technologies into present and future Navy systems. It provides a central point of contact for outside agencies on matters concerning the STO program.

Personnel: 15 full-time civilian

Key Personnel		Code
Name	Title	
Dr. D.W. Forester	Research Physicist	5050

Point of contact: Code 5050A, (202) 767-3116

Radar Division

Code 5300

Staff Activity Areas

AEGIS coordination
Marine Corps/IFF coordination

Electromechanical design
Multifunction RF systems

High-power millimeter wave radar
Digital array radar

Research Activity Areas

Radar Analysis

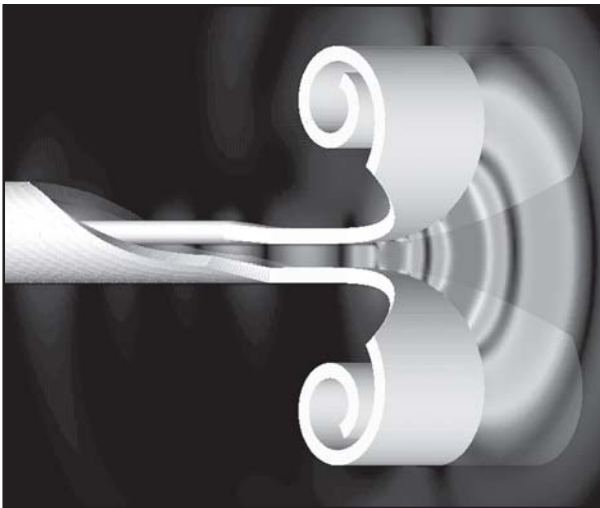
Target signature prediction
Electromagnetics and antennas
Airborne early-warning radar (AEW)
Inverse synthetic aperture radar (ISAR)
Space-time adaptivity

Advanced Radar Systems

High-frequency over-the-horizon radar
Signal analysis
Real-time signal processing and equipment
Computer Aided Engineering (CAE)
Electromagnetic Compatibility (EMC)
Electromagnetic Interference (EMI)
Mark XII IFF improvements
Future identification technology

Surveillance Technology

Shipboard surveillance radar
Ship self-defense
Electronic counter-countermeasures
Target signature recognition
Digital T/R modules
Sea clutter characterization
Ultrawideband technology
Dynamic waveform diversity
Information extraction
Ballistic missile defense
Mine detection



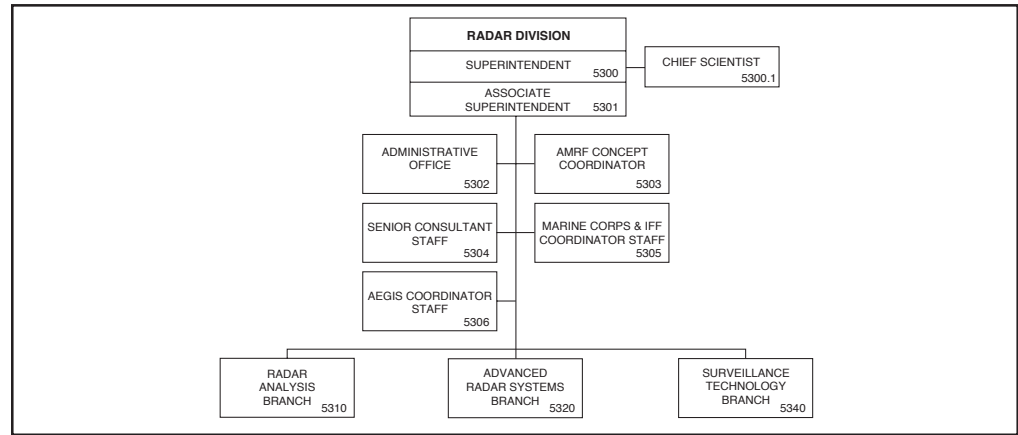
The radiation pattern at a point in time following introduction of a pulse of electromagnetic energy at the feed terminals of the element. This is an output of the electromagnetic computational capabilities of the Radar Division. It allows a researcher to investigate and perfect the performance of a design prior to actually building the element and testing it in an experiment setup, significantly shortening the development cycle.



Some of the experimental radar systems built and employed by the Radar Division. In the right center of the picture are the antenna and trailers of the AN/SPQ-9B Advanced Development Radar. To the left of the antenna are precision mounts used in a variety of experimental setups. In the upper right corner is the antenna mounting platform for the Engagement system, which currently is investigating means of implementing low-cost phased array radar system.



P.K. HUGHES II



Basic Responsibilities

The Radar Division conducts research on basic physical phenomena of importance to radar and related sensors, investigates new engineering techniques applicable to radar, demonstrates the feasibility of new radar concepts and systems, performs related systems analyses and evaluation of radar, and provides special consultative services. The emphasis is on new and advanced concepts and technology in radar and related sensors that are applicable to enhancing the Navy's ability to fulfill its mission.

Personnel: 104 full-time civilian

Key Personnel		
Name	Title	Code
Mr. P.K. Hughes II	Superintendent	5300
	Chief Scientist	5300.1
	Associate Superintendent	5301
	Administrative Officer	5302
	AMRF Concept Coordinator	5303
	Senior Consultant Staff	5304
	Marine Corps and IFF Coordinator	5305
	AEGIS Coordinator	5306
	Head, Radar Analysis Branch	5310
	Head, Advanced Radar Systems Branch	5320
	Head, Surveillance Technology Branch	5340

Point of contact: Code 5300, (202) 404-2700

Information Technology Division

Code 5500 Research Activity Areas

Navy Center for Applied Research in Artificial Intelligence

- Intelligent decision aids
- Natural language interfaces
- Intelligent software agents
- Machine learning
- Robotics software and computer vision
- Neural networks
- Novel devices/techniques for HCI
- Spatial Audio
- Immersive Simulation



Center for Computational Science meta-computer facility



The 128-processor Silicon Graphics Origin3800 system, currently with 128 Mbytes of RAM, the first production unit in the world with R14000 processors, was brought on-line in mid FY01.

Transmission Technology

- Arctic communication
- Communication system architecture
- Communication antenna/propagation technology
- Communications intercept systems
- Signal analysis systems
- Virtual engineering

Center for High Assurance Computer Systems

- Security architecture
- Formal specification/verification of system security
- COMSEC application technology
- Secure networks
- Secure databases
- Software engineering for secure systems
- Key management and distribution
- Certification and Infosec Engineering
- Formal methods for requirements specification and verification
- Security product development

Networks and Communication Systems

- Communication system engineering
- Mobile, wireless networking technology
- Bandwidth management (quality of service)
- Joint service tactical networking
- Integration of communication and C2 applications
- Automated testing of highly mobile tactical networks
- Reliable multicast protocols and applications
- Integrated IP and ATM multicasting
- Communication network simulation

- Networking protocols for directional antennas
- Policy-based network management
- Tactical voice-over IP
- Sensor networks
- Fastlane and Tactlane crypto testing

Advanced Information Technology

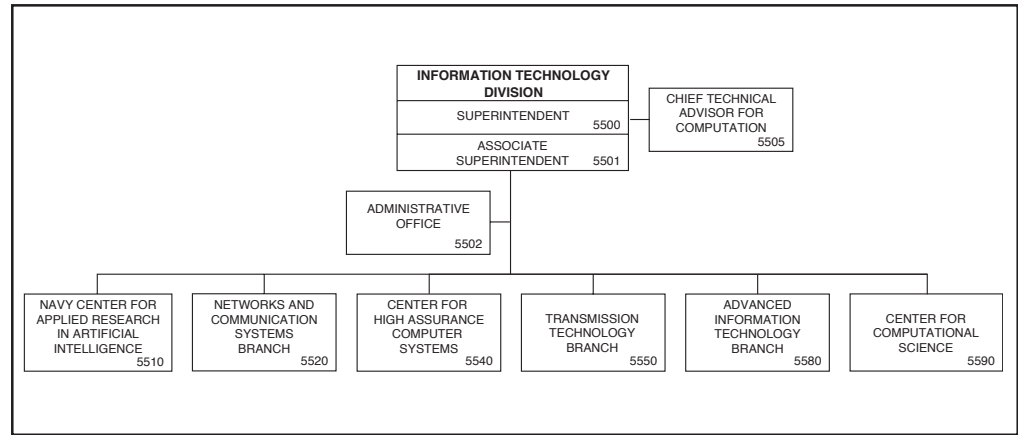
- Multiagent systems
- Scalable parallel computing
- Joint C4ISR and operational M&S systems
- Data fusion
- 3-D multimodal interaction
- Real-time parallel processing
- Distributed modeling and simulation (e.g., HLA, FOM development)
- Spatial feature temporal analysis
- Virtual reality/mobile augmented reality
- Natural environments for distributed simulation
- Collaborative engineering enterprise
- Model integration (physical, environmental, biological, psychological) for simulation
- Motion adaptation and vestibular research
- Agent technology for command center

Center for Computational Science

- Transparent optical network research and design
- Parallel computing
- Scalable high performance computing for Navy and DoD
- Distributed computing environments
- Scientific visualization
- Advanced networking streams
- High-definition video technology
- End user support for information technology and operational networks
- Lab-wide support for web, email, and other information services
- Test bed for global information grid



Dr. J.D. McLEAN



Basic Responsibilities

The Information Technology Division conducts research and development programs in the collection, transmission, and processing of information to provide a basis for improving the conduct of military operations. The organization of the Division is directed toward addressing the technologies and subsystems necessary to develop architectures and system designs for the next-generation battleforce warfare systems.

Personnel: 180 full-time civilian

Key Personnel		
Name	Title	Code
Dr. J.D. McLean	Superintendent/NRL Chief Information Officer**	5500
	Associate Superintendent	5501
	Administrative Officer	5502
	Chief Technical Advisor for Computation	5505
	Director, Navy Center for Applied Research in Artificial Intelligence	5510
	Head, Networks and Communication Systems Branch	5520
	Director, Center for High Assurance Computer Systems	5540
	Head, Transmission Technology Branch	5550
	Head, Advanced Information Technology Branch	5580
	Director, Center for Computational Science	5590
	Chief Librarian, Ruth H. Hooker Research Library	5596

Point of contact: Code 5501, (202) 767-2954

**Additional duty

Optical Sciences Division

Code 5600 Staff Activity Areas

Program analysis and development
Special systems analysis
Technical study groups

Technical contract monitoring
Theoretical studies

Research Activity Areas

Infrared Materials and Chemical Sensors

Advanced infrared glasses and fibers
IR fiber-optic materials and devices
IR fiber chemical and environmental sensors
IR transmitting windows
Transparent armor material
Planar waveguide devices
IR nonlinear materials

Framing reconnaissance sensors
Novel optical components
IR Range Facility
IR low observables
Multispectral/hyperspectral/detection algorithms
EO/IR systems analysis
Atmospheric IR measurements
Ship IR signatures
Airborne IR search and track technology

Optical Physics

Laser materials diagnostics
Nonlinear frequency conversion
Optical instrumentation and probes
Optical interactions in semiconductor superlattices and organic solids
Laser-induced reactions
Organic light emitting devices
Nano-optical and electrical research

Photonics Technology

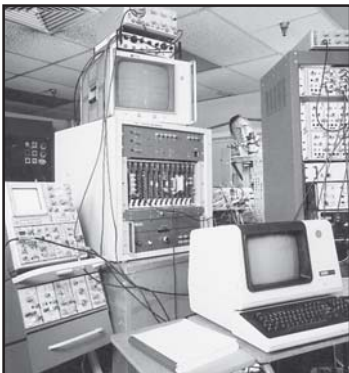
Fiber and solid-state laser/sources
High-speed (<100 fs) optical probing
High-power fiber amplifiers
High-speed fiber-optic communications
Antenna remoting
Free space communication
Photonic control of phased arrays
Optical clocks
Microwave photonics

Applied Optics

Detection signal processing studies
Optical and IR countermeasures
Optical technology
Ultraviolet component development and UV countermeasures
Multispectral sensors and processing
Missile warning sensor technology
UV, visible, and IR imager development

Optical Techniques

Radiation effects
Fiber lasers/sources and amplifiers
Fiber-optic materials and fabrication
Fiber Bragg grating sensors/systems for smart structures
Fiber-optic sensors/systems (acoustic, magnetic, gyroscopes)
Integrated optics
Optical sources for sensors



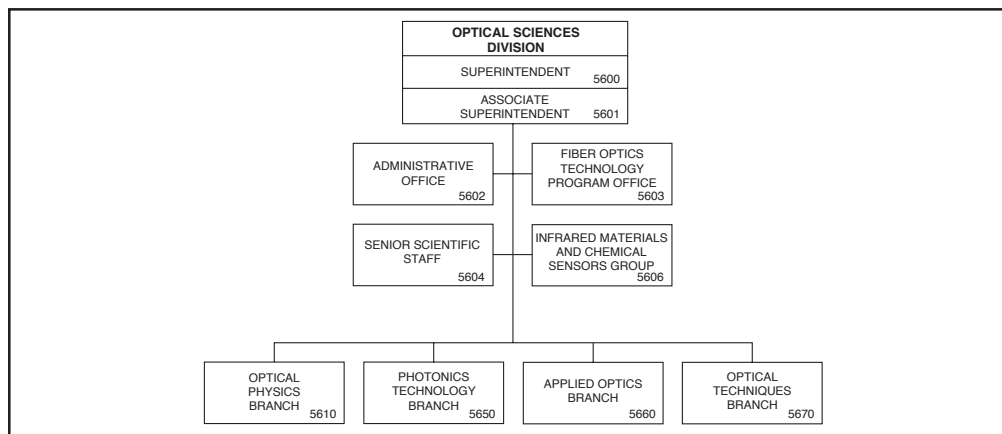
The Focal Plane Array Evaluation Facility consists of the optical sources and electronics required to evaluate monolithic or hybrid infrared focal plane arrays that use charge-coupled device, charge-injection device, direct readout, or charge-imaging matrix technologies



The Missile Seeker Evaluation Facility is a computerized facility that is used to evaluate optical countermeasures to infrared missile seekers and infrared imaging sensors



DR. T.G. GIALLORENZI



Basic Responsibilities

The Optical Sciences Division carries out a variety of research, development, and application-oriented activities in the generation, propagation, detection, and use of radiation in the wavelength region between near-ultraviolet and far-infrared wavelengths. The research, both theoretical and experimental, is concerned with discovering and understanding the basic physical principles and mechanisms involved in optical devices, materials, and phenomena. The development effort is aimed at extending this understanding in the direction of device engineering and advanced operational techniques. The applications activities include systems analysis, prototype system development, and exploitation of R&D results for the solution of optically related military problems. In addition to its internal program activities, the Division serves the Laboratory specifically and the Navy generally as a consulting body of experts in optical sciences. The work in the Division includes studies in quantum optics, laser physics, optical waveguide technologies, laser-matter interactions, atmospheric propagation, optical technology, holography, optical warfare, optical data processing, fiber-optic sensor systems, optical systems, optical materials, radiation damage studies, IR surveillance and missile seeker technologies, IR signature measurements, optical recording materials, and optical diagnostic techniques. A significant portion of the effort is devoted to developing, analyzing, and using special optical materials. Various field measurement programs on optical problems of specific interest are also conducted.

Personnel: 137 full-time civilian

Key Personnel		
Name	Title	Code
Dr. T.G. Giallorenzi	Superintendent	5600
	Associate Superintendent	5601
	Administrative Officer	5602
	Head, Fiber Optics Technology Program Office	5603
	Head, Senior Scientific Staff	5604
	Head, Infrared Materials and Chemical Sensors Group	5606
	Head, Optical Physics Branch	5610
	Head, Photonics Technology Branch	5650
	Head, Applied Optics Branch	5660
	Head, Optical Techniques Branch	5670

Point of contact: Code 5602, (202) 767-6986

Tactical Electronic Warfare Division

Code 5700 Staff Activity Areas

EW Strategic Planning
Information Warfare Technology Program
EW Lead Laboratory Coordinator

Navy Science Assistance Program (NSAP)
Effectiveness of Naval EW Systems (ENEWS)

Research Activity Areas

Offboard Countermeasures

Expendable technology and devices
Unmanned air vehicles
Offboard payloads
Decoys

Airborne Electronic Warfare Systems

Air systems development
Penetration aids
Power source development
Jamming and deception
Millimeter-wave technology
Communications CM

Ships Electronic Warfare Systems

Ships systems development
Jamming technology
Deception techniques
EW antennas

Electronic Warfare Support Measures

Intercept systems and direction finders
RF signal simulators
Systems integration
Command and control interfaces
Signal processing

Advanced Techniques

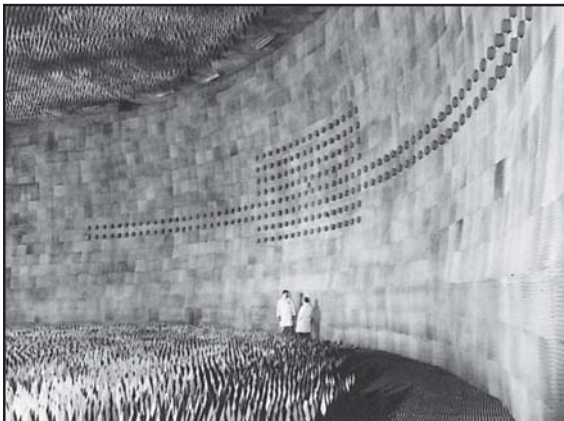
Analysis and modeling simulation
New EW techniques
Experimental systems
EW concepts
Infrared technology

Integrated EW Simulation

Hardware-in-the-loop simulation
Data management technology
Flyable ASM seeker simulators
Foreign military equipment exploitation



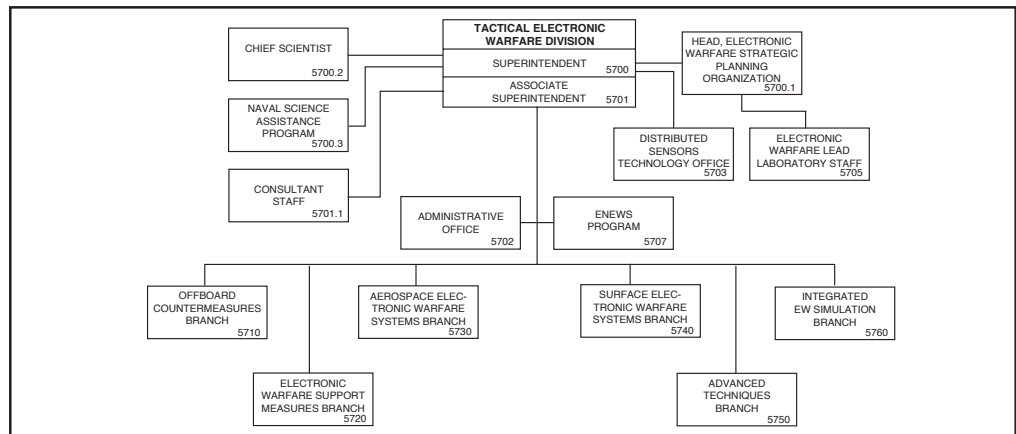
Using the latest composite, MMIC, and processing technologies, the Tactical Electronic Warfare Division has developed a small, lightweight, and inexpensive ESM receiving system for use on frigates, Coast Guard vessels, and various patrol aircraft



The Central Target Simulator (CTS) Programmable Array is part of a large hardware-in-the-loop simulation facility whose purpose is to test and evaluate electronic warfare systems and techniques used to counter the radar guided missile threat to Navy forces



DR. F.J. KLEMM



Basic Responsibilities

The Tactical Electronic Warfare Division (TEWD) is responsible for research and development in support of the Navy's tactical electronic warfare requirements and missions. These include electronic warfare support measures, electronic countermeasures, and supporting counter-countermeasures, as well as studies, analyses, and simulations for determining and improving the effectiveness of these systems.

Personnel: 237 full-time civilian

Key Personnel		Code
Name	Title	
Dr. F.J. Klemm	Superintendent	5700
	Head, Electronic Warfare Strategic Planning Organization	5700.1
	Chief Scientist	5700.2
	Head, Naval Science Assistance Program	5700.3
	Associate Superintendent	5701
	Consultant Staff	5701.1
	Administrative Officer	5702
	Head, Distributed Sensors Technology Office	5703
	Head, Electronic Warfare Lead Laboratory Staff	5705
	Manager, ENEWS Program	5707
	Head, Offboard Countermeasures Branch	5710
	Head, Electronic Warfare Support Measures Branch	5720
	Head, Aerospace Electronic Warfare Systems Branch	5730
	Head, Surface Electronic Warfare Systems Branch	5740
	Head, Advanced Techniques Branch	5750
	Head, Integrated Electronic Warfare Simulation Branch	5760

Point of contact: Code 5701, (202) 767-5974

**Materials
Science and
Component
Technology
Directorate**

MATERIALS SCIENCE AND COMPONENT TECHNOLOGY DIRECTORATE

Code 6000

The Materials Science and Component Technology Directorate carries out a multidisciplinary research program whose objectives are the discovery, invention, and exploitation of new improved materials, the generation of new concepts associated with materials behavior, and the development of advanced components based on these new and improved materials and concepts. Theoretical and experimental research is carried out to determine the scientific origins of materials behavior and to develop procedures for modifying these materials to meet important naval needs for advanced platforms, electronics, sensors, and photonics. The program includes investigations of a broad spectrum of materials including insulators, semiconductors, superconductors, metals and alloys, optical materials, polymers, plastics, and artificially structured bio/molecular materials and composites, which are used in important naval devices, components, and systems. New techniques are developed for producing, processing, and fabricating these materials for crucial naval applications.

The synthesis, processing, properties, and limits of performance of these new and improved materials in natural or radiation environments, components under deleterious conditions such as those associated with the marine environment, neutron or directed energy beam irradiation, or extreme temperatures and pressures, are established. For new materials design, emphasis is placed on protection of the environment.

Additionally, major thrusts are directed in advanced sensing, detection, reactive flow physics, computational physics, and plasma sciences. Areas of particular emphasis include nanoscience and technology, fluid mechanics and hydrodynamics, nuclear weapon effects simulations, high-energy density materials including fuels, propellants, explosives, and storage devices, interactions of various types of radiation with matter, survivability of materials and components, and directed energy devices.

Associate Director of Research for Materials Science and Component Technology



Dr. B.B. Rath was born in Banki, India, on October 28, 1934. He received a B.S. degree in physics and mathematics from Utkal University, an M.S. in metallurgical engineering from Michigan Technological University, and a Ph.D. from the Illinois Institute of Technology.

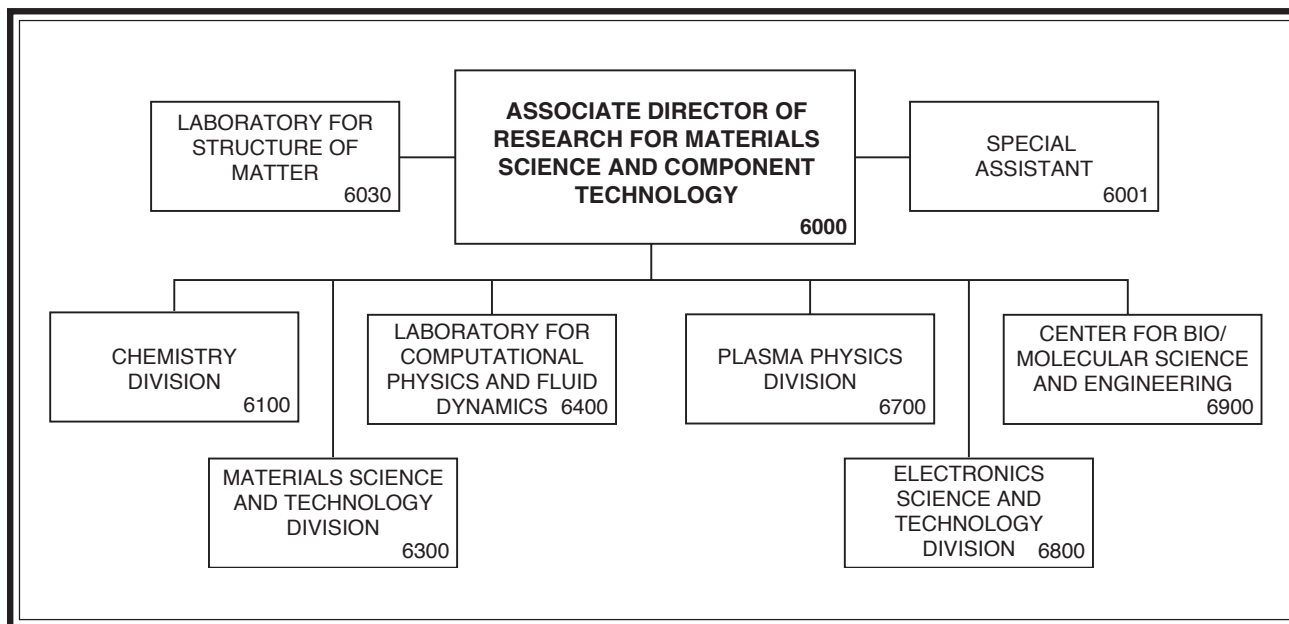
Dr. Rath was Assistant Professor of Metallurgy and Materials Science at Washington State University from 1961 to 1965. From 1965 to 1972, he was with the staff of the Edgar C. Bain Laboratory for fundamental research of the U.S. Steel Corporation. From 1972 to 1976, he headed the Metal Physics Research Group of the McDonnell Douglas Research Laboratories in St.

Louis, Missouri, until he came to NRL as Head of the Physical Metallurgy Branch. During this period, he was adjunct Professor at the Carnegie-Mellon University, the University of Maryland, and the Colorado School of Mines. Dr. Rath served as Superintendent of the Materials Science and Technology Division from 1982 to 1986, when he was appointed to his present position.

Dr. Rath is recognized in the fields of solid-state transformations, grain boundary migrations, and structure-property relationships in metallic systems. He has published over 160 papers in these fields and edited several books and conference proceedings.

Dr. Rath serves on several planning, review, and advisory boards for both the Navy and the Department of Defense, as well as for the National Materials Advisory Board of the National Academy of Sciences, University of Virginia, Colorado School of Mines, University of Pittsburgh, University of Connecticut, University of Maryland, Carnegie-Mellon University, and Florida Atlantic University. He serves as the Navy representative and was the Executive Chair to the Materials and Structures Group of The Technical Cooperation Program (TTCP) countries and the Indo-U.S. Joint Commission on Science and Technology.

Dr. Rath is a Fellow of the Minerals, Metals, and Materials Society (TMS), American Society for Materials-International (ASM), Washington Academy of Sciences, Indian Academy of Engineering, British Institute of Materials (IOM), and Materials Research Society of India. For his contributions to Materials Research, he has received the 1991 George Kimball Burgess Memorial Award, TMS Leadership Award, the Charles S. Barrett Medal, the Chandrasekhar Medal and Award in 1998, the Presidential Rank Award in 1999, Presidents' Meritorious Executive Award, Distinguished Lecture in Materials and Society Award, Distinguished ASM Life Member Award, THERMEC-2000 Distinguished Award, The National Materials Advancement Award, and the 2001 American Society for Materials (ASM) Distinguished Life Membership Award, and NRL's Lifetime Achievement Award in 2004. He has served as chairperson of several technical committees of TMS, ASM, and AAES, and serves in the editorial boards of three international materials research journals. He is a member of the Board of Trustees of ASM-International and the Federation of Materials Societies, and Board of Directors of The Materials Society (TMS).



Name	Key Personnel Title	Code
Dr. B.B. Rath	Associate Director of Research for Materials Science and Component Technology	6000
	Special Assistant	6001
Dr. J. Karle	Chief Scientist, Laboratory for Structure of Matter	6030
Dr. J.S. Murday	Superintendent, Chemistry Division	6100
Dr. D.U. Gubser	Superintendent, Materials Science and Technology Division	6300
Dr. J.P. Boris	Chief Scientist and Director, Laboratory for Computational Physics and Fluid Dynamics	6400
Dr. S.L. Ossakow	Superintendent, Plasma Physics Division	6700
Dr. G.M. Borsuk	Superintendent, Electronics Science and Technology Division	6800
Dr. J.M. Schnur	Director, Center for Bio/Molecular Science and Engineering	6900

Point of contact: Code 6000A, (202) 767-2538

**Dr. Jerome Karle recipient of
1985 Nobel Prize in Chemistry**



Dr. Jerome Karle's research has been concerned with diffraction theory and its application to the determination of atomic arrangements in various states of aggregation, gases, liquids, amorphous solids, fibers, and macromolecules. This research has resulted in new techniques for structure determination and a broad variety of applications. His work in crystal structure analysis was recognized by the 1985 Nobel Prize in Chemistry.

Dr. Karle is a Fellow of the American Physical Society, a member of the National Academy of Sciences, and the American Philosophical Society. He has served as president of the International Union of Crystallography, and is a member of a number of other professional societies. He has been chairman of the Chemistry Section of the National Academy of Sciences. Some time ago, he was a Professorial Lecturer in the University College of the University of Maryland and a Visiting Professor at the University of Kiel in Germany. He has also lectured at many international schools and symposia and has served on a number of international scientific organizations.

Laboratory for Structure of Matter

Code 6030



DR. J. KARLE

Basic Responsibilities

The Laboratory for Structure of Matter carries out experimental and theoretical investigations of the atomic, molecular, glassy, and crystalline structures of materials. The methods of X-ray, electron, and neutron diffraction are used in a broad program of structural studies that can form the basis for understanding and interpreting the results of research investigations in a wide variety of scientific disciplines. Structural investigations relate structure to function, facilitate industrial syntheses and the creation of new materials with improved properties, and provide foundation information for numerous associated disciplines and studies. Applications are made, for example, to propellants, explosives, dense energetic materials, absorptive carbons, metallic glasses, device materials, ion carriers, antibiotics, analgesics, reversible oxygen carriers, and synthetic reaction intermediates and final products.

Personnel: 8 full-time civilian

Key Personnel		
Name	Title	Code
Dr. J. Karle	Chief Scientist	6030

Point of contact: Code 6030, (202) 767-3496

Chemistry Division

Code 6100 Staff Activity Areas

The Environment and Biotechnology Program Manager

Research Activity Areas

Chemical Diagnostics

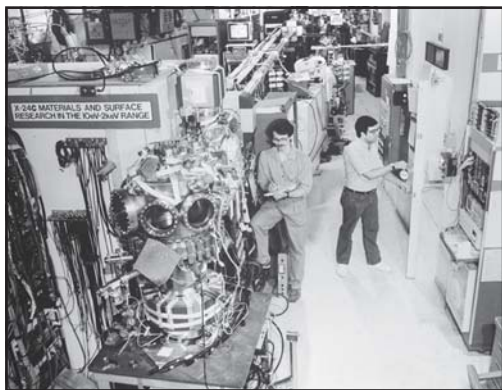
- Optical diagnostics of chemical reactions
- Kinetics of gas phase reactions
- Trace analysis
- Atmosphere analysis and control
- Ion/molecule processes
- Environmental chemistry/microbiology
- Methane hydrates
- Laboratory on a chip

Materials Chemistry

- Synthesis and evaluation of innovative polymers
- Functional organic coatings
- Polymer characterization
- Magnetic resonance
- Degradation and stabilization mechanisms
- High-temperature resins
- OMCVD materials

Center for Corrosion Science and Engineering

- Materials failure analysis
- Marine coatings
- Cathodic protection
- Corrosion science
- Environmental fracture and fatigue
- Corrosion control engineering



The NRL National Synchrotron Light Source research station for materials and surface research

Surface/Interface Chemistry

- Tribology
- Surface properties of materials
- Surface/interface analysis
- Chemical/biological microdetectors
- Surface reaction dynamics
- Diamond films
- Nanostructures
- Electrochemistry
- Synchrotron radiation applications
- Radiation detection and measurement

Safety and Survivability

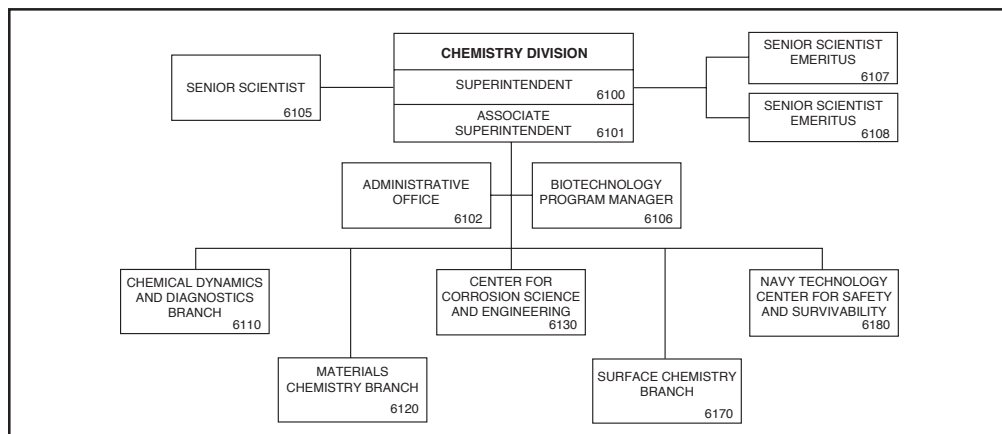
- Combustion dynamics
- Fire protection and suppression
- Personnel protection
- Modeling and scaling of combustion systems
- Chemical and biological defense
- Mobility fuels



The Key West site of the NRL Center for Corrosion Science and Engineering specializes in understanding and modeling of the marine environments impact on Naval materials. A complete laboratory for the study of corrosion control technologies provides sponsors with prototypical seawater exposure of their systems.



Dr. J.S. MURDAY



Basic Responsibilities

The Chemistry Division conducts basic research, applied research, and development studies in the broad fields of chemical/structural diagnostics, reaction rate control, materials chemistry, surface and interface chemistry, corrosion passivation, environmental chemistry, and ship safety/survivability. Specialized programs within these fields include coatings, functional polymers/elastomers, clusters, controlled release of energy, physical and chemical characterization of surfaces, electrochemistry, assembly and properties of nanometer structures, tribology, chemical vapor deposition/etching, atmosphere analysis and control, environmental protection/reclamation, prevention/control of fires, mobility fuels, modeling/simulation, and miniaturized sensors for chemical, biological, nuclear, and radiation hazards.

To enhance protection of Navy personnel and platforms from damage and injury in peace and wartime, the Navy Technology Center for Safety and Survivability performs RDT&E on fire and personnel protection, fuels, chemical defense, submarine atmospheres, and damage control aspects of ship and aircraft survivability; supports Navy and Marine Corps requirements in these areas; and acts as a focus for technology transfer in safety and survivability.

Personnel: 106 full-time civilian; 4 full-time military; 4 part-time

Key Personnel

Name	Title	Code
Dr. J.S. Murday	Superintendent	6100
	Associate Superintendent	6101
	Administrative Officer	6102
	Senior Scientist	6105
	Biotechnology Program Manager	6106
	Head, Chemical Dynamics and Diagnostics Branch	6110
	Head, Materials Chemistry Branch	6120
	Head, Center for Corrosion Science and Engineering	6130
	Head, Surface Chemistry Branch	6170
	Head, Navy Technology Center for Safety and Survivability	6180

Point of contact: Code 6102, (202) 767-2460

Materials Science and Technology Division

Code 6300 Research Activity Areas

Physical Metallurgy

- Ferrous and intermetallic alloys
- Synthesis/processing of metals
- Welding technology
- Micro-/nanostructure characterization

Computational Materials Science

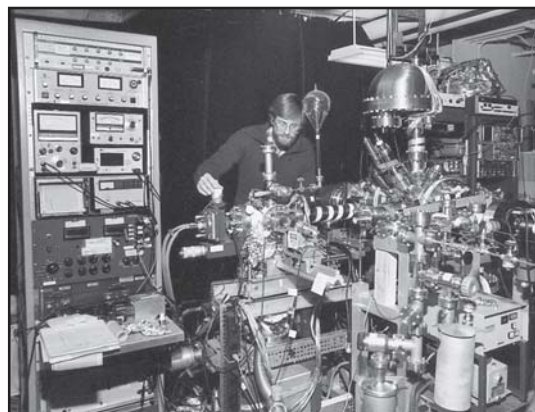
- Condensed matter theory
- Electronic structure of solids and clusters
- Molecular dynamics
- Quantum many-body theory
- Theory of magnetic materials
- Theory of alloys
- Semiconductor and surface physics
- Theoretical studies of phase transitions
- Atomic physics theory
- Theory of piezoelectric materials

Directed Energy Effects

- Laser-hardened materials and systems
- Laser point defense
- Nanostructure optics
- High-power laser interactions with materials and systems
- Atomic and molecular interactions with surfaces and interfaces
- Spectroscopy of superconductors

Surface Modification

- Thin film deposition
 - Pulsed laser deposition
 - Ion-beam-assisted deposition
 - Variable balance magnetron sputtering



- Ion engineering

- Ion implantation
 - Reactive ion etching

- Functional materials

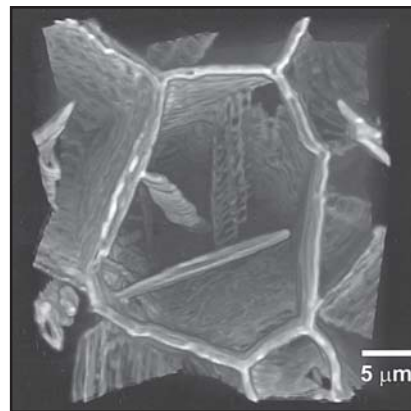
- Optoelectronics
 - Electroceramics
 - Chemical sensors

- Analysis

- Surface analysis by accelerator techniques

- Trace element accelerator mass spectrometry

- Mechanical loss spectroscopy



3D reconstruction of cementite precipitates in an austenite grain

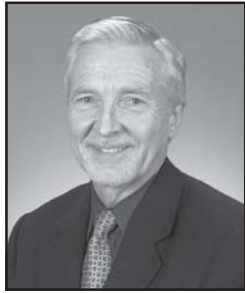
Material Physics

- Superconducting materials
- Magnetic materials
- Thermoelectric materials
- Nonlinear (chaotic) phenomena

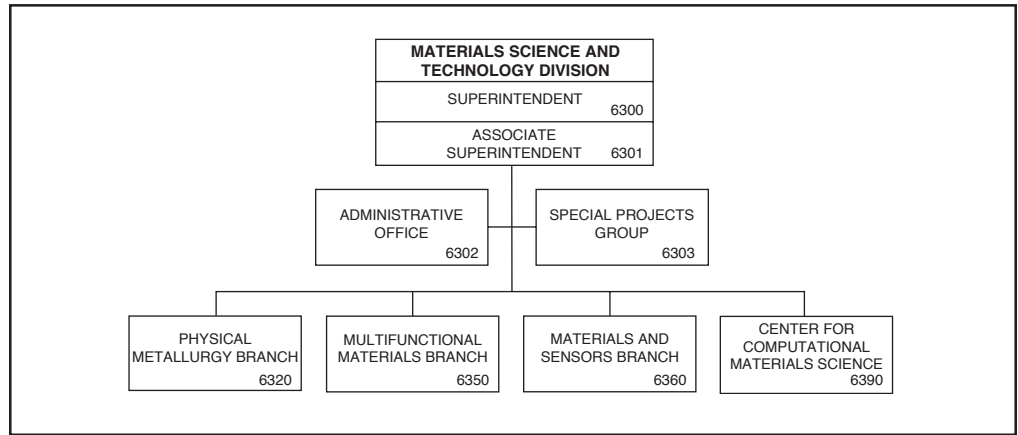
Multifunctional Materials

- Composite multifunctional material systems
 - Structure-plus-power
 - Structure-plus-conduction
 - Structure-plus-acoustics
- Corrosion simulation and control
 - Modeling of electrochemical corrosion systems
 - Evaluation of cathodic protection system performance
- Computational modeling of active materials
- Mesoscale material characterization and simulation
 - Image-based modeling
 - Materials by design
- Biochemical surrogates and response simulation
- Synthesis and processing of advanced ceramics
 - High energy density dielectrics
 - Piezoelectrics
- Rapid prototyping

The growth of single crystal magnetic films on semiconductor substrates for electronic applications is observed



DR. D.U. GUBSER



Basic Responsibilities

The Materials Science and Technology Division conducts basic and applied research and engages in exploratory and advanced development of materials having substantive value to the Navy. R&D programs encompass the intrinsic behavior of metals, insulators, composites, and ceramics, including efforts in ferrous alloys, intermetallic compounds, superconducting, dielectric, and magnetic materials, films and coatings, and multifunctional materials systems. The programs encompass advanced synthesis and processing techniques as well as postprocessing techniques to fabricate sensors, devices, structures, and components. A variety of state-of-the-art characterization tools are used to probe the atomic and microstructure nature (composition and structure) of the materials as well as to delineate the fundamental properties of the material or material system. Response of materials and material systems to a variety of external influences (mechanical, chemical, optical, electromagnetic radiation, high-power lasers, temperature, etc.) is integral to the division's programs as well as performance and reliability projections for military service lifetime. The program includes strong theoretical, computational, and simulation efforts to predict, guide, and explain the behavior of materials and materials systems. Studies conducted in the division will provide guidance for the selection, design, certification, and life-cycle management of material in naval vehicles and systems. The diversity of R&D programs in the division is carried out by multidisciplinary teams of materials scientists, metallurgists, ceramists, physicists, chemists, and engineers using the most advanced testing facilities and diagnostic techniques.

Personnel: 140 full-time civilian

Key Personnel		
Name	Title	Code
Dr. D.U. Gubser	Superintendent	6300
	Associate Superintendent	6301
	Administrative Officer	6302
	Head, Special Projects Group	6303
	Head, Physical Metallurgy Branch	6320
	Head, Multifunctional Materials Branch	6350
	Head, Materials and Sensors Branch	6360
	Head, Center for Computational Materials Science	6390

Point of contact: Code 6300A, (202) 767-2926

Laboratory for Computational Physics and Fluid Dynamics

Code 6400 Research Activity Areas

Reactive Flows

- Fluid dynamics in combustion
- Turbulence in compressible flows
- Multiphase flows
- Turbulent jets and wakes
- Turbulence modeling
- Computational hydrodynamics
- Propulsion systems analysis
- Contaminant transport modelling
- Fire and explosion mitigation



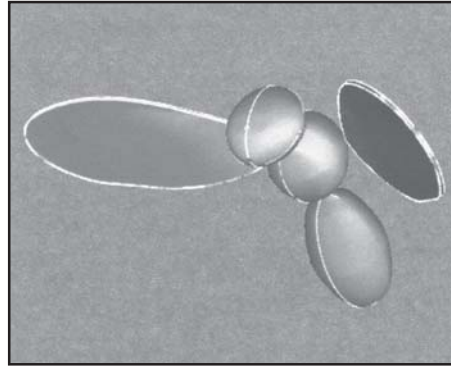
Olive (32P) and Snuffy (24P) — Origins at work



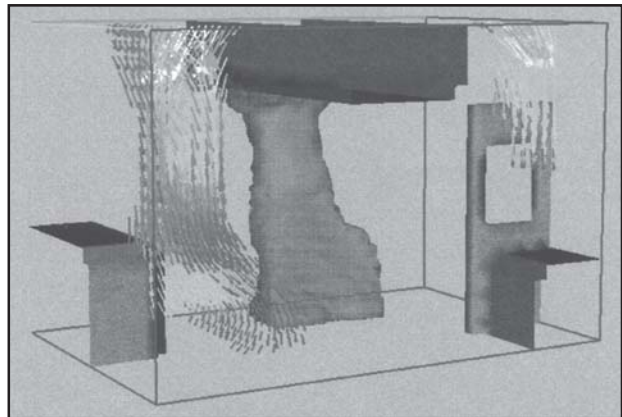
This figure shows a contaminant cloud from a FAST3D-CT simulation of downtown Chicago using a $360 \times 360 \times 55$ grid (6 m resolution). A 3 m/s wind off the lake from the left blows contaminant across a portion of the detailed urban geometry. The contaminant is lofted rapidly above the tops of the majority of the buildings due to their geometrical effect.

Computational Physics Developments

- Laser plasma interactions
- Inertial confinement fusion
- Solar physics modeling
- Dynamical gridding algorithms
- Advanced graphical and parallel processing systems
- Electromagnetic and acoustic scattering
- Microfluidics
- Fluid structure interaction
- Shock and blast containment



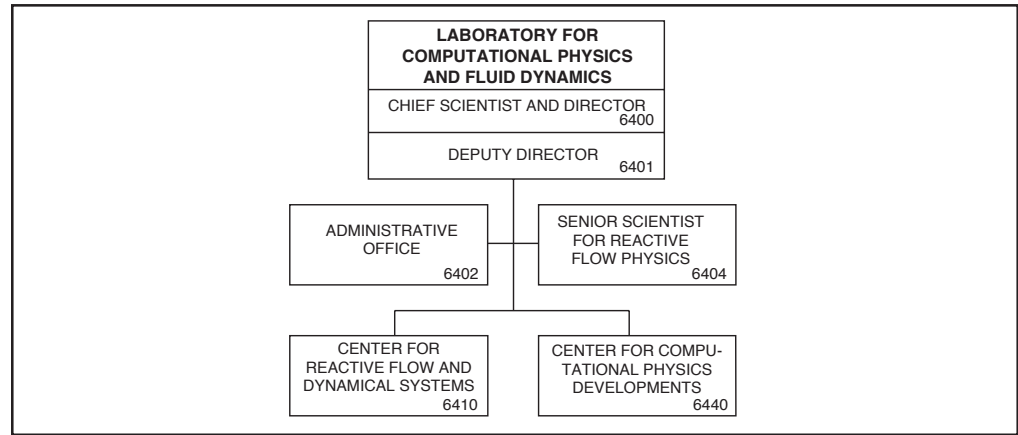
Unstructured grid technology has been used to obtain the surface pressure distribution on a hovering fruitfly *Drosophila*. Such computations are being carried out to gain insights into unsteady force production in nature that may guide in the design of insect-like autonomous air vehicles for the Navy.



Water-mist trajectories and temperature distributions during the suppression of a fire inside a complex ship compartment. Simulations and experiments have shown that using fine water-mist can significantly reduce the amount of water needed for fire suppression.



Dr. J.P. BORIS



Basic Responsibilities

The Laboratory for Computational Physics and Fluid Dynamics is responsible for the research leading to and the application of advanced analytical and numerical capabilities that are relevant to Navy, DoD, and other programs of national interest. This research is pursued in the fields of compressible and incompressible fluid dynamics, reactive flows, fluid/structure interaction including submarine and aerospace applications, atmospheric and solar geophysics, magnetoplasma dynamics for laboratory and space applications, application of parallel processing to large-scale problems such as unstructured grid generation for complex flows and target tracking and correlation for battle management, and in other disciplines of continuum and quantum computational physics as required to further the overall mission of the Naval Research Laboratory. The specific objectives of the Laboratory for Computational Physics and Fluid Dynamics are to develop and maintain state-of-the-art analytical and computational capabilities in fluid dynamics and related fields of physics; to establish in-house expertise in parallel processing for large-scale scientific computing; to perform analyses and computational experiments on specific relevant problems using these capabilities; and to transfer this technology to new and ongoing projects through cooperative programs with the research divisions at NRL and elsewhere.

Personnel: 26 full-time civilian

Key Personnel		
Name	Title	Code
Dr. J.P. Boris	Chief Scientist and Director	6400
	Deputy Director	6401
	Administrative Officer	6402
	Senior Scientist for Reactive Flow Physics	6404
	Head, Center for Reactive Flow and Dynamical Systems	6410
	Head, Center for Computational Physics Developments	6440

Point of contact: Code 6402, (202) 767-6581

Plasma Physics Division

Code 6700

Research Activity Areas

Radiation Hydrodynamics

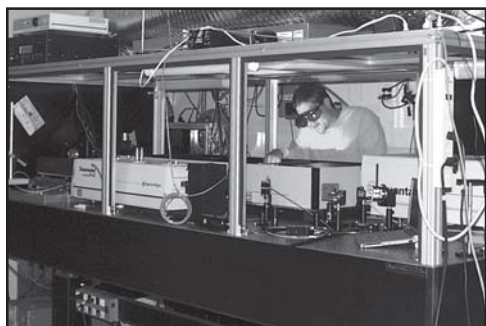
- Radiation hydrodynamics of Z-pinches and laser-produced plasmas
- X-ray source development
- Cluster dynamics in intense laser fields
- X-ray channeling and propagation
- Plasma kinetics for directed energy and fusion applications
- Plasma discharge physics
- Dense plasma atomic physics, equation of state
- Numerical simulation of high-density plasma

Laser Plasma

- Nuclear weapons stockpile stewardship
- Laser fusion, inertial confinement
- Megabar high-pressure physics
- Rep-rate KrF laser development
- Strongly coupled plasmas
- Laser fusion technology
- Laser fusion energy

Charged Particle Physics

- Electrodeless plasma discharges for lighting
- Applications of modulated electron beams
- Rocket, satellite, and shuttle-borne natural and active experiments
- Laboratory simulation of space plasma processes



The NRL Ti:Sapphire Femtosecond Laser (TFL) currently operates at 50 fsec, 0.8 TW and provides a facility to conduct research in intense laser-plasma interactions, ultrashort intense laser propagation in the atmosphere, remote sensing of chem/bio agents, and laser induced electrical discharges.

- Large-area plasma processing sources
- Atmospheric and ionospheric GPS sensing
- Ionospheric effects on communications
- Electromagnetic launchers

Pulsed Power Physics

- Production, focusing, and propagation of intense electron and ion beams
- High-power, pulsed radiography
- Plasma radiator and bremsstrahlung diode source development
- Capacitive and inductive energy storage
- Nuclear weapons effects simulation
- Electromagnetic launchers
- Ion-beam inertial confinement fusion

Beam Physics

- Advanced accelerators and radiation sources
- Microwave, plasma, and laser processing of materials
- Microwave sources: Magnicons and gyrotrons
- Nonlinear dynamics
- Ultrahigh intensity laser-matter interactions
- Free electron lasers and laser synchrotrons
- Theory and simulation of space and solar plasmas
- Ionospheric modification
- Space weather modeling
- Rocket and space diagnostics
- Laser propagation in the atmosphere

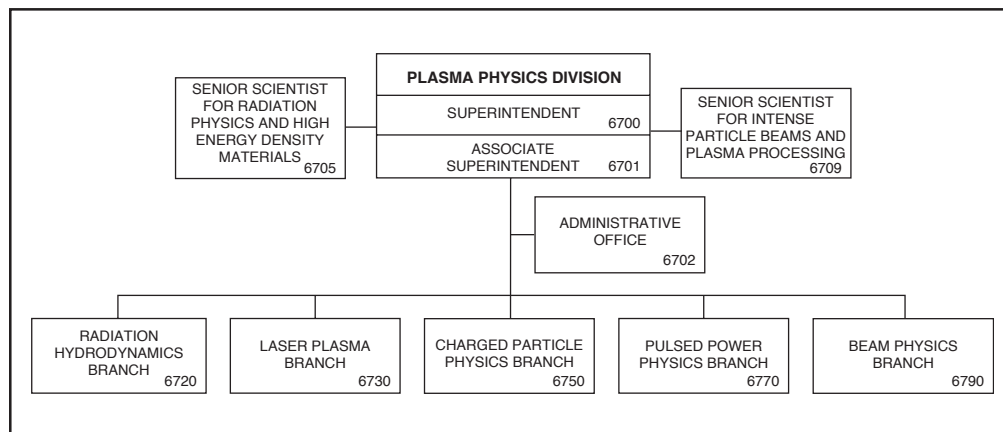


The Nike is the world's largest Krypton Fluoride (KrF) laser. Its operation is funded by the U.S. Department of Energy to explore physics issues for laser fusion. Shown is the propagation bay where 56 short duration (4-5 ns) beams are directed

by mirrors first to the electron-beam-pumped amplifiers and then to the target facility. The Nike KrF system achieves extremely uniform high-intensity illumination of planar targets by overlapping numerous smoothed laser beams. Typical experiments include studies of the ablative acceleration of matter to high velocities (100 km/sec) and studies of the reaction of materials to very high pressures (10 million atmospheres) produced by the laser light.



DR. S.L. OSSAKOW



Basic Responsibilities

The Plasma Physics Division conducts a broad theoretical and experimental program of basic and applied research in plasma physics, laboratory discharge, and space plasmas, intense electron and ion beams and photon sources, atomic physics, pulsed power sources, laser physics, advanced spectral diagnostics, and nonlinear systems. The effort of the Division is concentrated on a few closely coordinated theoretical and experimental programs. Considerable emphasis is placed on large-scale numerical simulations related to plasma dynamics; ionospheric, magnetospheric, and atmospheric dynamics; nuclear weapons effects; thermonuclear plasma confinement; atomic physics; plasma processing; nonlinear dynamics and chaos; free electron lasers and other advanced radiation sources; advanced accelerator concepts; and intense ultra-short pulse laser propagation in air. Areas of experimental interest include: laser-plasma, laser-electron beam, laser-matter interactions, high energy laser weapons, laser shock hydrodynamics, thermonuclear fusion, electromagnetic wave generation, the generation of intense electron and ion beams, large-area plasma processing sources, electromagnetic launchers, high-frequency microwave processing of ceramic materials, high-intensity electrodeless discharge lamps, advanced accelerator development, inductive energy storage, laboratory simulation of space plasma phenomena, and in-situ and remote sensing space plasma measurements.

Personnel: 115 full-time civilian

Key Personnel		
Name	Title	Code
Dr. S.L. Ossakow	Superintendent	6700
	Associate Superintendent	6701
	Administrative Officer	6702
	Senior Scientist, Radiation Physics and High Energy Density Materials	6705
	Senior Scientist, Intense Particle Beams and Plasma Processing	6709
	Head, Radiation Hydrodynamics Branch	6720
	Head, Laser Plasma Branch	6730
	Head, Charged Particle Physics Branch	6750
	Head, Pulsed Power Physics Branch	6770
	Head, Beam Physics Branch	6790

Point of contact: Code 6701, (202) 767-2997

Electronics Science and Technology Division

Code 6800 Research Activity Areas

Electronic Materials

- Preparation and development of magnetic, dielectric, optical, and semiconductor materials including micro and nanostructures
- Electrical, optical, and magneto-optical studies of semiconductor microstructures and nanostructures, superlattices, surfaces, and interfaces
- Impurity and defect studies
- Surface research and interface physics
- Theoretical solid state physics

Microwave Technology

- Microwave and millimeter-wave integrated circuits and components research
- High-frequency device design, simulation, and fabrication
- Reliability and failure physics of electronic devices and circuits
- High temperature superconductors

Power Electronics

- Power device design, simulation, and fabrication
- High voltage/high temperature power device and components research
- Growth and characterization of wide bandgap and thin film materials for power devices
- Wafer bonding for power devices and novel substrates
- Reliability and failure physics of power devices

Nanoelectronics

- Characterization of nanosurfaces and interfaces
- Nanoelectronic device research and fabrication
- Processing research for nanometric devices

Radiation Effects

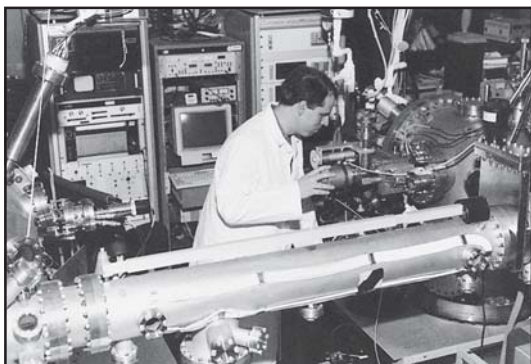
- Space experiments and satellite survivability
- Single event and total ionizing dose effects
- Radiation tolerant ultralow-power microelectronics/design and test
- Ultrafast charge collection
- Environmental hazard remediation
- Advanced photovoltaic technologies
- Femtosecond laser research
- Radiation effects in microelectronics and photonics

Solid State Devices

- Solid state optical sensors
- Hardening of electronic devices, circuits, and optoelectronic sensors
- Very far infrared photodiodes/arrays
- Microelectronics device research and fabrication
- Solid state circuits research
- Signal processing research

Vacuum Electronics

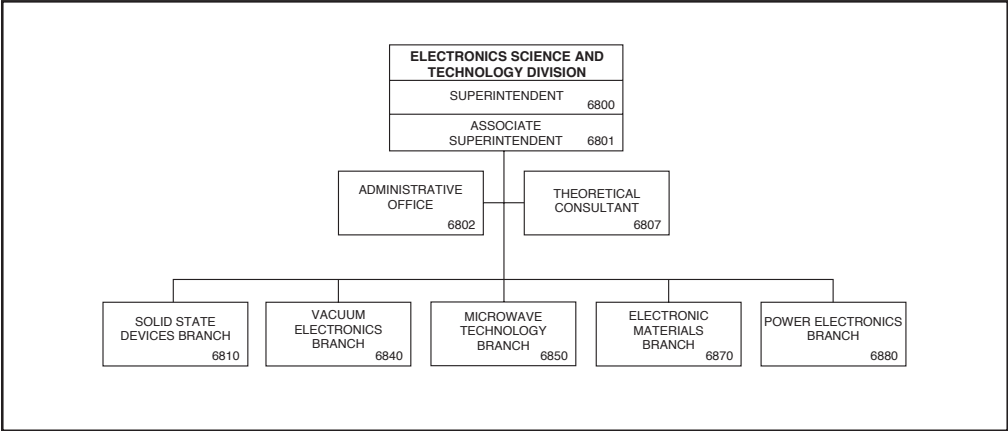
- Compact microwave and millimeter wave power amplifier research and development
- Cathode research and development
- Materials development for RF electronics applications
- Electron emission science
- High power millimeter-wave components: fabrication and cooling technology
- Techniques for high data rate digital communications



The EPICENTER specializes in molecular beam epitaxial growth of nanostructures created by alternating layers of narrow bandgap materials made available from four ultrahigh vacuum chambers. These structures are expected to improve the performance of far-infrared detectors, midwave lasers, and superhigh frequency transistors and resonant tunneling diodes. Here a scientist creates a structure using high vacuum, chamber-to-chamber sample transfer.



Dr. G.M. BORSUK



Basic Responsibilities

The Electronics Science and Technology Division conducts programs of basic science and applied research and development in materials growth and properties, surface physics, micro and nanostructure electronics, microwave techniques, microelectronic device research and fabrication, vacuum electronics, and cryoelectronics, including superconductors. The activities of the Division couple device research both to basic materials investigations and to systems research and development needs.

Personnel: 94 full-time civilian

Key Personnel		
Name	Title	Code
Dr. G.M. Borsuk	Superintendent	6800
	Associate Superintendent	6801
	Administrative Officer	6802
	Theoretical Consultant	6807
	Head, Solid State Devices Branch	6810
	Head, Vacuum Electronics Branch	6840
	Head, Microwave Technology Branch	6850
	Head, Electronic Materials Branch	6870
	Senior Scientist for Nanoelectronics	6877
	Head, Power Electronics Branch	6880

Point of contact: Code 6801, (202) 767-3894

Center for Bio/Molecular Science and Engineering

Code 6900 Research Activity Areas

Biologically Derived Microstructures

Self-assembly, molecular machining
Synthetic membranes
Nanocomposites
Tailored electronic materials
Low observables
Molecular engineering, biomimetic materials
Molecular imprinting
Viral scaffolds

Biosensors

Binding polypeptides and proteins
Cell-based biosensor
DNA biosensor
Fiber-optic biosensor
Flow immunosensor
Array-based sensors

Environmental Quality

Soil/groundwater explosives detection
Antifouling paint, controlled release

Molecular Biology

Proteomics of marine bacteria
Tissue engineering
Gene arrays, biomarkers

Polymers and Liquid Crystals

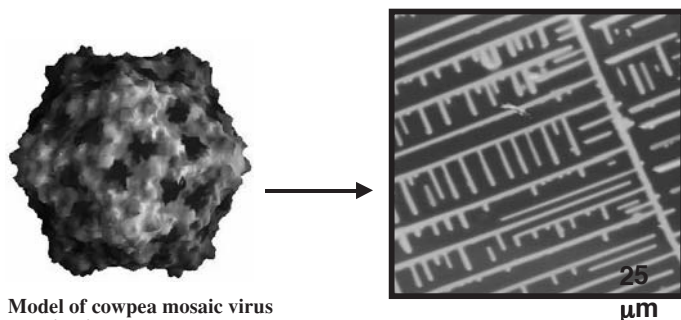
Ferroelectric liquid crystals
Advanced materials/information processing
Flexible displays, noninvasive alignment technique
Liquid crystal-based cell imaging
Liquid crystal elastamers

Surfaces and Interfaces

Uncooled IR detectors/imagers
Submicron resists and microlithography
Specifically activated thin films
Neuronal patterning

Energy Harvesting

Biomaterials for charge storage
Ocean Floor Biofuel Cell

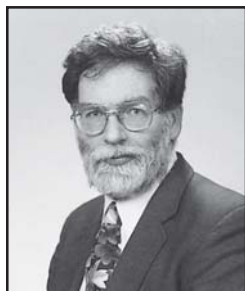


Model of cowpea mosaic virus showing icosahedral symmetry.

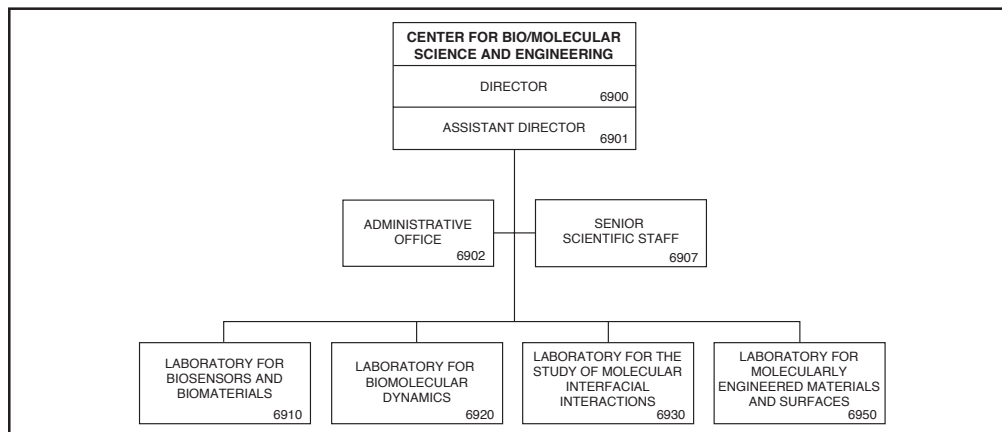
Self-assembled virus nanoblocks. Self-organization of cowpea mosaic virus particles on surfaces leads to extended orthogonal pattern.



The optical properties of liquid crystals can be used as an amplifying medium to image topology of biological structures, as illustrated by these enhanced images of isolated muscle and fat cells.



Dr. J.M. SCHNUR



Basic Responsibilities

The Center for Bio/Molecular Science and Engineering is using the tools of modern biology, physics, chemistry, and engineering to develop advanced materials and sensors. The long-term research goal is first to gain a fundamental understanding of the relationship between molecular architecture and the function of materials, then apply this knowledge to solve problems for the Navy and DoD community. The key theme is the study of complex bio/molecular systems with the aim of understanding how “nature” has approached the solution of difficult structural and sensing problems. Technological areas currently being studied include molecular and microstructure design, molecular biology, self-assembly, controlled release and encapsulation, and surface patterning and modification. Much of the research deals with the self-assembly of lipids, proteins, and liquid crystals into complex microstructures for use in advanced material applications, and the harnessing of the recognition functions of proteins and cells for the development of advanced sensors. A highly multidisciplinary staff is required to pursue these research and development programs. The Center provides a stimulating environment for cross-disciplinary programs in the areas of immunology, biochemistry, electrochemistry, inorganic and polymer chemistry, microbiology, microlithography, photochemistry, biophysics, spectroscopy, advanced diagnostics, organic synthesis, and electro-optical engineering.

Personnel: 49 full-time civilian

Key Personnel		
Name	Title	Code
Dr. J.M. Schnur	Director	6900
	Assistant Director	6901
	Administrative Officer	6902
	Head, Senior Scientific Staff	6907
	Head, Laboratory for Biosensors and Biomaterials	6910
	Head, Laboratory for Biomolecular Dynamics	6920
	Head, Laboratory for the Study of Molecular Interfacial Interactions	6930
	Head, Laboratory for Molecularly Engineered Materials and Surfaces	6950

Point of contact: Code 6902, (202) 404-6015

**Ocean and
Atmospheric
Science and
Technology
Directorate**

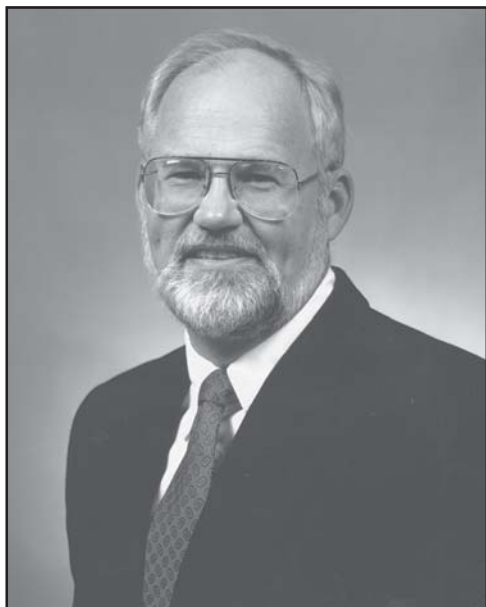
OCEAN AND ATMOSPHERIC SCIENCE AND TECHNOLOGY DIRECTORATE

Code 7000

The Ocean and Atmospheric Science and Technology Directorate performs research and development in the fields of acoustics, remote sensing, oceanography, marine geosciences, marine meteorology, and space science. Areas of emphasis in acoustics include advanced acoustic concepts and computation, acoustic signal processing, physical acoustics, acoustic systems, ocean acoustics, and acoustic simulation and tactics. Areas of emphasis in remote sensing include radio, infrared, and optical sensors, remote sensing physics and hydrodynamics, remote sensing simulation, and imaging systems. Areas of emphasis in oceanography include coastal and open ocean dynamics and prediction, coastal and open ocean processes, and remote sensing applications to oceanography. Areas of emphasis in marine geosciences include marine physics, seafloor sciences, and

geospatial information science and technology mapping, charting, and geodesy. Areas of emphasis in marine meteorology include atmospheric dynamics for theater-wide, tactical scale prediction systems and forecast support, and meteorological applications development. Areas of emphasis in space science include middle and upper atmosphere physics, solar terrestrial relationships, solar physics, and higher energy astronomy. Senior naval officers are assigned as military advisors to help maintain the directorate focus on operational Navy and other DoD requirements in these areas of emphasis. The directorate is responsible for administrative and technical support to major activities in Washington, DC; Stennis Space Center, Mississippi; and Monterey, California.

Associate Director of Research for Ocean and Atmospheric Science and Technology



Dr. E.O. Hartwig was born in Cincinnati, Ohio on November 22, 1946. He obtained his B.S. degree in biological sciences from the University of Texas at El Paso in 1968, and his Ph.D. from Scripps Institution of Oceanography in 1974. After completing his graduate studies, Dr. Hartwig accepted a position as a researcher at the Scottish Marine Biological Association (SMBA) in Oban, Scotland, where he established a seagoing experimental marine microbiological effort.

In 1975, Dr. Hartwig returned to the U.S., accepting a position at the Chesapeake Bay Institute of Johns Hopkins University. His shallow water research concentrated on the Chesapeake Bay and its outflow region, in active collaboration with many

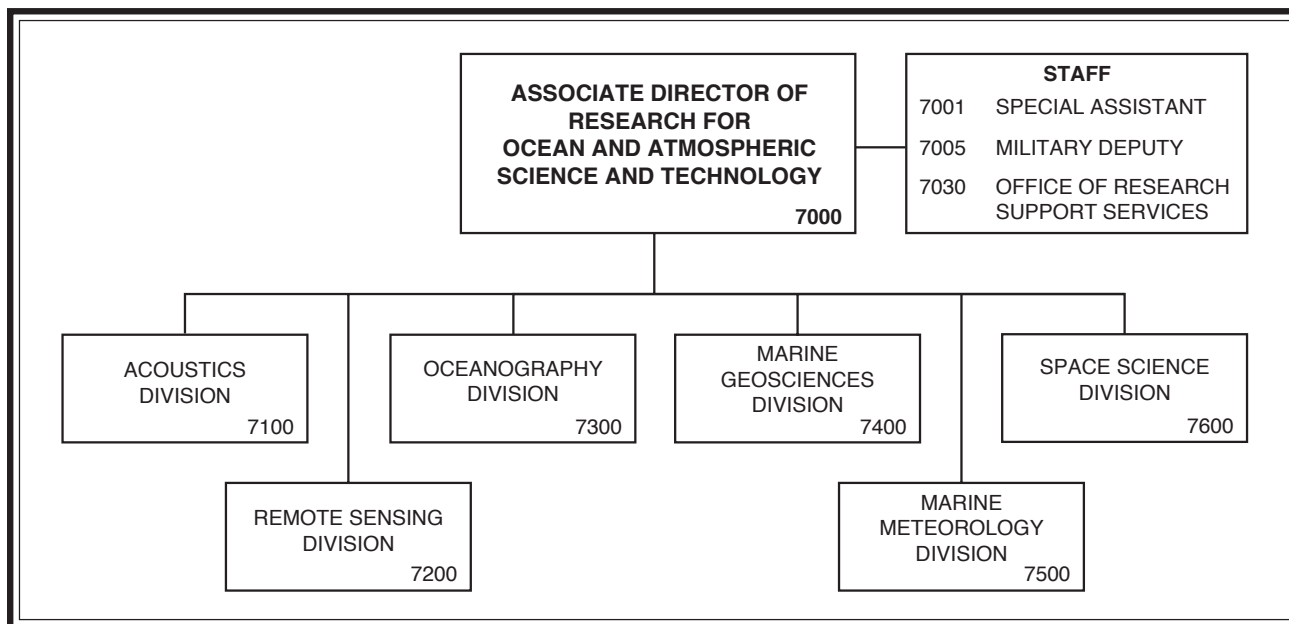
institutions and scientists. The efforts sought to understand the biological dynamics associated with the Bay's flow regimes, and studied the underlying water column and benthic biological processes resulting in the onset of the seasonal summer anoxia of the bay.

In 1978, Dr. Hartwig accepted a position at Marine Ecological Consultants (MEC), where his research centered on understanding the "before operations" environment at a nuclear generating station. In 1980, Dr. Hartwig accepted a position at the Lawrence Berkeley Laboratory (LBL) at the University of California at Berkeley to head up the biological component of a research team studying the concept of a proposed Ocean Thermal Energy Conversion (OTEC) plant. His work involved extensive interactions with engineers on the operating characteristics of the plant and physical oceanographers modeling flow regimes around the plant and to be generated by the plant.

Following his research at LBL, Dr. Hartwig joined the Office of Naval Research in 1982 as a scientific officer in the Oceanic Chemistry/Biology Program. When the program was split into an Oceanic Chemistry and Oceanic Biology Program, Dr. Hartwig became Program Manager of the Oceanic Biology Program. Here, Dr. Hartwig developed several major interdisciplinary research initiatives for the Navy.

In 1987, Dr. Hartwig was selected as Director of Ocean Sciences at ONR. He enhanced both university interactions with Ocean Sciences and the stature of ONR Ocean Science scientific officers and program managers in the Federal Government. Dr. Hartwig, working with the Oceanographer of the Navy, developed and implemented the Navy's academic research vessel rebuild program, which has resulted in fewer, more capable oceanographic vessels for the next millennium.

Dr. Hartwig joined NRL in October 1992 as Associate Director of Research for Ocean and Atmospheric Science and Technology. In 1996 and again in 2001, Dr. Hartwig was presented the Presidential Rank Award of Meritorious Executive in the Senior Executive Service (SES). In 2002, Dr. Hartwig became President of The Oceanography Society, an international scientific organization.



Key Personnel		
Name	Title	Code
Dr. E.O. Hartwig	Associate Director of Research for Ocean and Atmospheric Science and Technology	7000
	Special Assistant	7001
	Military Deputy	7005
Dr. H.C. Eppert, Jr.	Head, Office of Research Support Services	7030
Dr. E.R. Franchi	Superintendent, Acoustics Division	7100
	Naval Science (Acoustic) Research Coordinator	7105
Dr. R.M. Bevilacqua*	Superintendent, Remote Sensing Division	7200
	Military Deputy	7205
Dr. R.H. Preller	Superintendent, Oceanography Division	7300
	Military Deputy	7305
Dr. H.C. Eppert, Jr.	Superintendent, Marine Geosciences Division	7400
	Military Deputy	7405
Dr. S.W. Chang	Superintendent, Marine Meteorology Division	7500
	Military Deputy	7505
Dr. H. Gursky	Superintendent, Space Science Division	7600
	Space Test Program Officer	7603

Point of contact: Code 7000A, (202) 404-8174

*Acting

Office of Research Support Services

Code 7030 Staff Activity Areas

Office of Research Support

- Conference coordination, video teleconferencing
- Data communications
- Data networking
- Computer network maintenance

Security Office

- Information security
- Physical security
- Industrial security
- AIS security
- Personnel security
- Classification
- SCIF management
- Security investigations
- Navy message center
- Classified material control

Facilities/Administrative Information Office

- Directives, reports, forms
- Mail management
- Facilities planning
- Vehicles
- Shipment via FedEx and common carriers

HPC Management Office

- Supercomputing interface management

Safety/Environmental Office

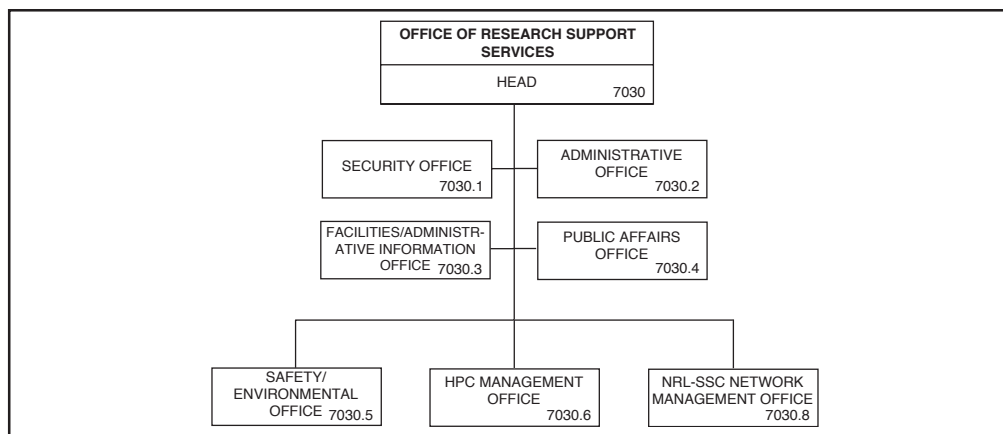
- Industrial/laboratory safety
- Specialized safety training
- Hazard abatement
- Mishap prevention
- Hazardous materials program
- Hazardous waste disposal

Public Affairs Office

- Community relations
- News releases
- Exhibits
- Information
- Freedom of Information Act



Dr. H.C. EPPERT, JR.



Basic Responsibilities

The Office of Research Support Services is responsible for the operational and management support necessary for the day-to-day operations at NRL Stennis Space Center, Mississippi (NRL-SSC). The Head of NRL-SSC acts for the Commanding Officer in dealing with local Naval, Federal, and civil activities and personnel on matters relating to NRL-SSC support activities and facilities, community and multicommand issues, and safety and disaster control measures.

Support functions include security, public affairs, safety, high-performance computer management, and support services to include management, administration, and facilities.

Personnel: 11 full-time civilian

Key Personnel		Code
Name	Title	
Dr. H.C. Eppert, Jr.	Head	7030
	Head, Security Office	7030.1
	Administrative Officer	7030.2
	Head, Facilities/ Administrative Information Office	7030.3
	Public Affairs Office	7030.4
	Safety/ Environmental Officer	7030.5
	HPC Management Office	7030.6
	NRL-SSC Network Management Office	7030.8

Point of contact: Code 7030, (228) 688-4010; DSN 828-4010

Acoustics Division

Code 7100 Staff Activity Areas

Special programs management

System concepts and studies

Research Activity Areas

Acoustic Signal Processing

- Random media propagation
- Limits of acoustic array performance
- Underwater acoustic communications
- Undersea noise signal characterization and modeling
- Surf zone noise generation
- Shallow water acoustic surveillance methods
- Fish absorption of acoustic signals
- Geophysical inversion
- Matched field processing and inversion
- High-frequency acoustic flow visualization

Physical Acoustics

- Structural acoustics
- Active sound control
- Fiber-optic acoustic sensors
- Acoustics of coatings
- Dynamics of complex structures
- Target strength/radiation modeling
- Acoustic transduction
- Inverse scattering
- Nanomicrostructure dynamics



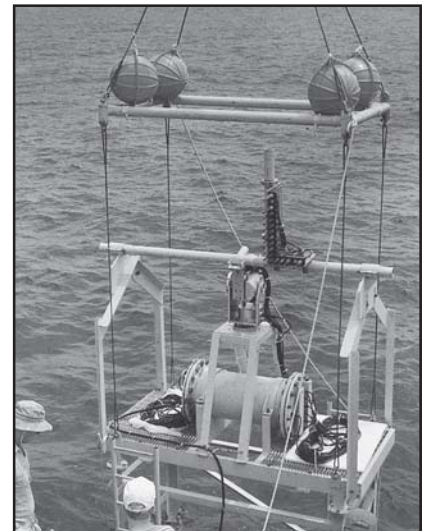
Structural acoustic studies in the one-million gallon Acoustic Holographic Pool Facility

Acoustic Systems

- Ocean boundary scattering
- Shallow water active classification
- Statistical characterization of reverberation
- Active sonar performance modeling
- Matched field processing
- Acoustic inversion techniques
- Acoustic propagation
- Nonlinear signal propagation
- Acoustics of bubbly media

Acoustic Simulation, Measurements, and Tactics

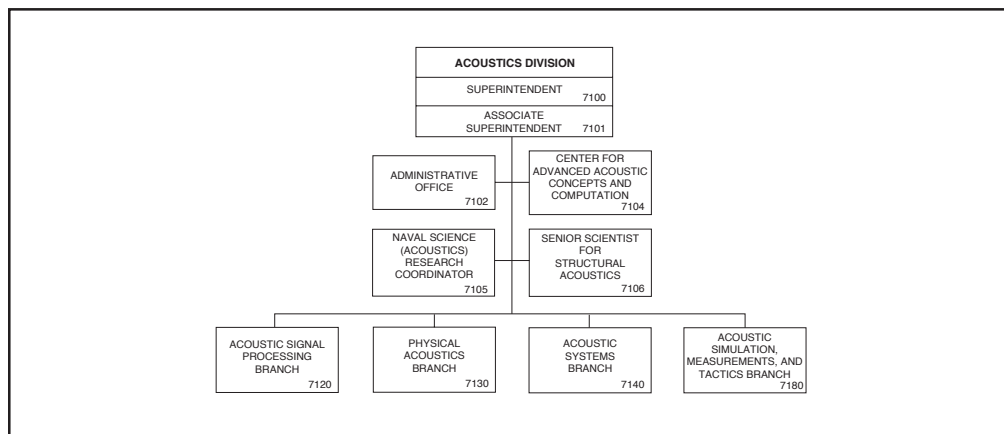
- Coupled dynamic ocean and acoustic modeling
- Ocean acoustic propagation and scattering models
- Ocean ambient noise models and simulation
- Superconductor and scalable acoustic models
- Fleet application acoustic models
- Environmental acoustic assessments and characterizations
- High-frequency seafloor and ocean acoustic measurements
- Coastal acoustic measurements and studies
- Biologic ocean volume reverberation measurements
- Multisensor system optimization
- Tactical oceanography simulations and databases
- Warfare effectiveness studies and optimizations



Deployment of high-frequency acoustics tower



Dr. E.R. FRANCHI



Basic Responsibilities

The Acoustics Division conducts basic and applied research in undersea physics. The basic research areas are signal processing, ocean acoustics and the associated description of the ocean environment as it impacts advanced systems, and physical acoustics. The applied spectrum includes developing and proving system concepts; signal processing for active and passive detection, tracking, and classification of underwater targets; echo strength; structural acoustics; large area assessment techniques; and development of processing systems and techniques. Also included are basic and applied research in simulations and tactics as influenced by the environment. The Division program is interactive with the ONR Contract Research Program and other research laboratories, both U.S. and foreign.

Personnel: 104 full-time civilian; 1 full-time military

Key Personnel		
Name	Title	Code
Dr. E.R. Franchi	Superintendent	7100
	Associate Superintendent	7101
	Administrative Officer	7102
	Head, Center for Advanced Acoustic Concepts and Computation	7104
	Naval Science (Acoustics) Research Coordinator	7105
	Senior Scientist for Structural Acoustics	7106
	Head, Acoustic Signal Processing Branch	7120
	Head, Physical Acoustics Branch	7130
	Head, Acoustic Systems Branch	7140
	Head, Acoustic Simulation, Measurements, and Tactics Branch	7180

Point of contact: Code 7100, (202) 767-3482

Remote Sensing Division

Code 7200 Research Activity Areas

Remote Sensing

Sensors

- SAR
- Imaging RAR
- Passive microwave imagers
- CCDs and focal plane arrays
- Fabry-Perot spectrometers
- Imaging spectrometers
- Radio interferometers
- Optical interferometers
- Adaptive optics
- Lidar
- Spaceborne and airborne systems

Areas

- Radiative transfer modeling
- Coastal oceans
- Marine ocean boundary layer
- Polar ice
- Middle atmosphere
- Global ocean phenomenology
- Environmental change
- Ocean surface wind vector
- Ionosphere

Astrophysics

- Optical interferometry
- Radio interferometry
- Fundamental astrometry and reference frames
- Fundamental astrophysics
- Star formation
- Stellar atmospheres and envelopes
- Interstellar medium, interstellar scattering
- Pulsars
- Low-frequency astronomy

Optical Head
Assembly (OHA)
of the Polar Ozone
and Aerosol
Measurement
(POAM-II)
experiment
payload

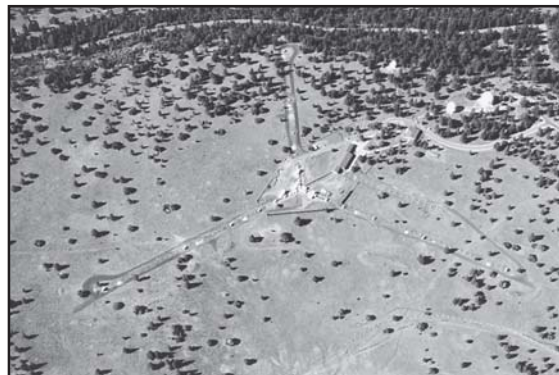


Physics of Atmospheric/Ocean Interaction

- Mesoscale, fine-structure, and microstructure
- Aerosol and cloud physics
- Mixed layer and thermocline applications
- Sea-truth towed instrumentation techniques
- Turbulent jets and wakes
- Nonlinear and breaking ocean waves
- Stratified and rotating flows
- Turbulence modeling
- Boundary layer hydrodynamics
- Marine hydrodynamics
- Computational hydrodynamics

Imaging Research/Systems

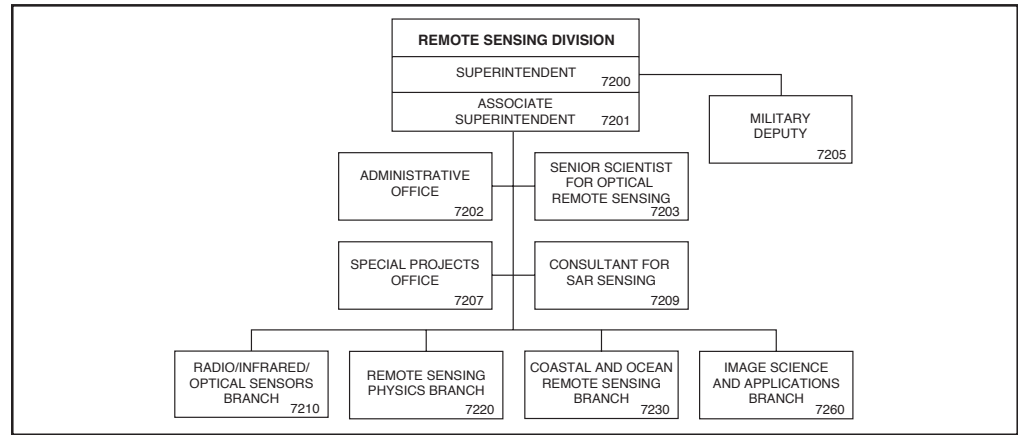
- Remotely sensed signatures analysis/simulation
- Real-time signal and image processing algorithm/systems
- Asymmetric optical communications
- Image data compression methodology
- Image fusion
- Automatic target recognition
- Scene/sensor noise characterization
- Image enhancement/noise reduction
- Scene classification techniques
- Radar and laser imaging systems studies
- Coherent/incoherent imaging sensor exploitation
- Numerical modeling simulation
- Environmental imagery analysis



The Navy Prototype Optical Interferometer produces the highest angular resolution images ever made at optical wavelengths. Its four astrometric elements (the rectangular huts) provide extremely precise star positions for use by the U.S. Naval Observatory in navigation and time keeping. The imaging elements are mounted on piers extending out the "Y" configuration. Light from all the telescopes is carried down evacuated pipes and combined in the optics laboratory to produce images of stellar surfaces.



DR. R.M. BEVILACQUA*



Basic Responsibilities

The Remote Sensing Division conducts a program of basic research, science, and applications aimed at the development of new concepts for sensors and imaging systems for objects and targets on the Earth, in the near-Earth environment, and in deep space. The research, both theoretical and experimental, deals with discovering and understanding the basic physical principles and mechanisms that give rise to target and background emission and to absorption and emission by the intervening medium. The accomplishment of this research requires the development of sensor systems technology. The development effort includes active and passive sensor systems to be used for the study and analysis of the physical characteristics of phenomena that give rise to naturally occurring background radiation, such as that caused by the Earth's atmosphere and oceans, as well as man-made or induced phenomena, such as ship/submarine hydrodynamic effects. The research includes theory, laboratory, and field experiments leading to ground-based, airborne, or space systems for use in such areas as remote sensing, astrometry, astrophysics, surveillance, nonacoustic ASW, and improved meteorological support systems for the operational Navy. Special emphasis is given to developing space-based platforms and exploiting existing space systems.

Personnel: 103 full-time civilian; 1 full-time military

Key Personnel		
Name	Title	Code
Dr. R.M. Bevilacqua*	Superintendent	7200
	Associate Superintendent	7201
	Administrative Officer	7202
	Senior Scientist for Optical Remote Sensing	7203
	Military Deputy	7205
	Head, Special Projects Office	7207
	Consultant for SAR Sensing	7209
	Head, Radio/Infrared/Optical Sensors Branch	7210
	Head, Remote Sensing Physics Branch	7220
	Head, Coastal and Ocean Remote Sensing Branch	7230
	Head, Image Science and Applications Branch	7260

Point of contact: Code 7200, (202) 767-2351

*Acting

Oceanography Division

Code 7300 Staff Activity Areas

Special studies

Research Activity Areas

Ocean Dynamics and Prediction

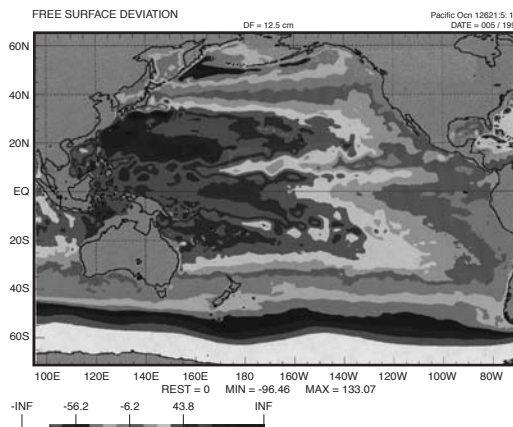
- Ocean prediction
 - Large scale
 - Arctic
 - Shipboard
 - Data assimilation
 - Coastal and semi-enclosed sea
- Ocean observing system simulation
- Coastal scene generation

Ocean Sciences

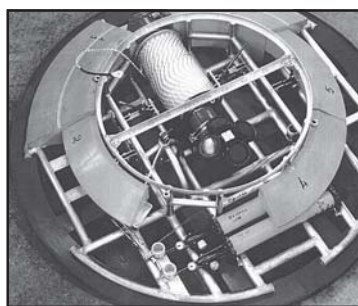
- Dynamical processes
 - Coastal current systems
 - Waves and bubbles
- Coupled systems
 - Air/ocean/acoustic coupling
 - Biodynamics
- Remote sensing applications
 - Color/hyperspectral signatures
 - Ocean optics



Optical mooring equipment for shallow water showing attenuation and absorption meters and irradiance sensors



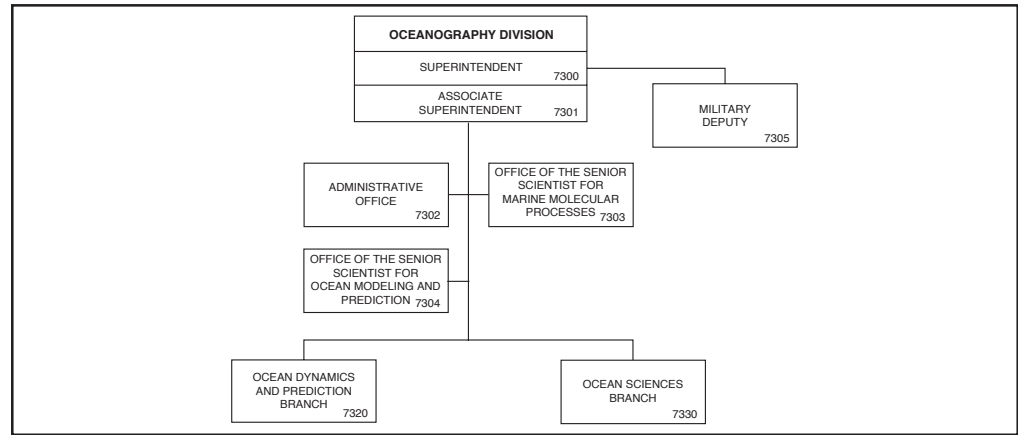
NRL layered ocean model output of sea surface height for Pacific Ocean, 5 January 1995. This model has been transitioned to NAVOCEANO.



NRL's ten 300 kHz ADCPs are matched with trawl-resistant bottom mounts. This photo shows a bottom mount with its exterior fiberglass shell and some internal buoyancy segments removed. The internal recording instruments collect frequent profiles of horizontal current for intervals of up to several months. A wave and tide gauge may also be included in the housing. With an operating depth of 300 m, the instruments permit operations nearly everywhere on the world's continental shelves.



Dr. R.H. PRELLER



Basic Responsibilities

The Oceanography Division conducts basic and applied research in description and modeling of biological, physical, and dynamical processes in open ocean, regional, and littoral areas; in exploitation of satellite, airborne, and in-situ sensors for environmental characterization; and in investigation and application of microbial processes to Navy problems. The oceanographic research is both theoretical and experimental in nature and is focused on understanding and modeling ocean, coastal, and littoral area hydro/thermodynamics, circulation, waves, ice dynamics, air-sea exchange, optics, and small and microscale processes. Analytical methods and algorithms are developed to provide quantitative retrieval of geophysical parameters of Navy interest from state-of-the-art sensor systems. The Division work includes analysis of biological processes that mediate and control optical properties of the oceans, coastal, and littoral regions and microbially induced corrosion/metal microbe interaction. The Division programs are designed to be responsive to and to anticipate Naval needs. Transition of Division products to the DoD, Navy systems developers, operational Navy, and civilian (dual use) programs is a primary goal. The Division's programs are coordinated and interactive with other NRL programs and activities, ONR's research programs, and other government agencies involved in oceanographic activities. The Division also collaborates and cooperates with scientists from the academic community and other U.S. and foreign laboratories.

Personnel: 76 full-time civilian; 1 full-time military

Key Personnel		
Name	Title	Code
Dr. R.H. Preller	Superintendent	7300
	Associate Superintendent	7301
	Administrative Officer	7302
	Office of the Senior Scientist for Marine Molecular Processes	7303
	Office of the Senior Scientist for Ocean Modeling and Prediction	7304
	Military Deputy	7305
	Head, Ocean Dynamics and Prediction Branch	7320
	Head, Ocean Sciences Branch	7330

Point of contact: Code 7302, (228) 688-4114; DSN 828-4114

Marine Geosciences Division

Code 7400 Research Activity Areas

Marine Geology

- Sedimentary processes
- Foreshore sediment transport
- Sediment microstructure
- Pore fluid flow
- Diapirism, volcanism, faulting, mass movement
- Biogenic and thermogenic methane
- Hydrate distribution, formation, and dissociation

Marine Geophysics

- Seismic wave propagation
- Earthquake seismology
- Physics of low-frequency acoustic propagation
- Acoustic energy interaction with topography and inhomogeneities
- Gravimetry and geodesy
- Geomagnetic modeling

Marine Geotechnique

- Acoustic seafloor characterization
- Geoacoustic modeling
- Geotechnical properties and behavior of sediments
- Measurement and modeling of high-frequency acoustic propagation and scattering
- Mine burial processes
- Marine biogeochemistry
- Animal-microbe-sediment interactions
- Early sediment diagenesis

- Sedimentary microbial respiration of manganese and iron
- Whole-cell bioluminescent reporter strain construction

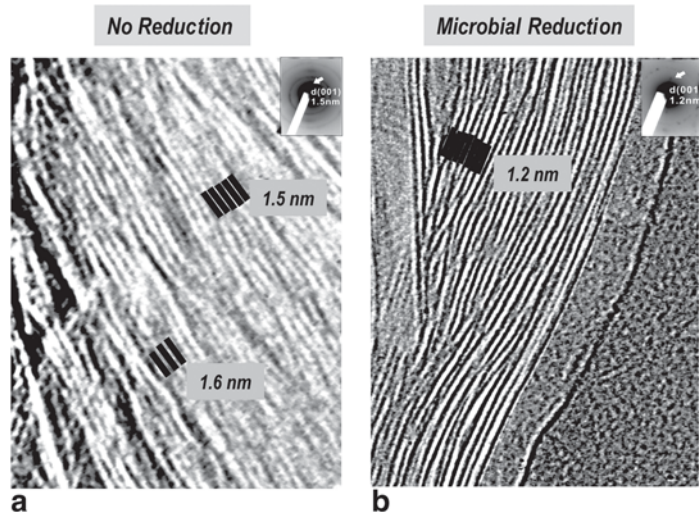
Mapping and Charting

- Digital database design
- Digital product analysis and standardization
- Data compression techniques and exploitation
- Hydrographic survey techniques
- Bathymetry extraction techniques from remote and acoustic imagery
- Utility software development for digital mapping databases
- Observation and modeling of nearshore morphodynamics

In Situ and Laboratory Sensors

- High-resolution subseafloor 2-D and 3-D seismic imaging
- Laser/hyperspectral bathymetry/topography
- Swath acoustic backscatter imaging
- Sediment pore water pressure, permeability, and undrained shear strength
- Compressional and shear wave velocity and attenuation
- Airborne geophysics, gravity, and magnetics
- Seafloor magnetic fluctuation
- Sediment microfabric change with pore fluid and/or gas change
- Instrumented mine shapes
- Bottom currents and pressure fluctuations

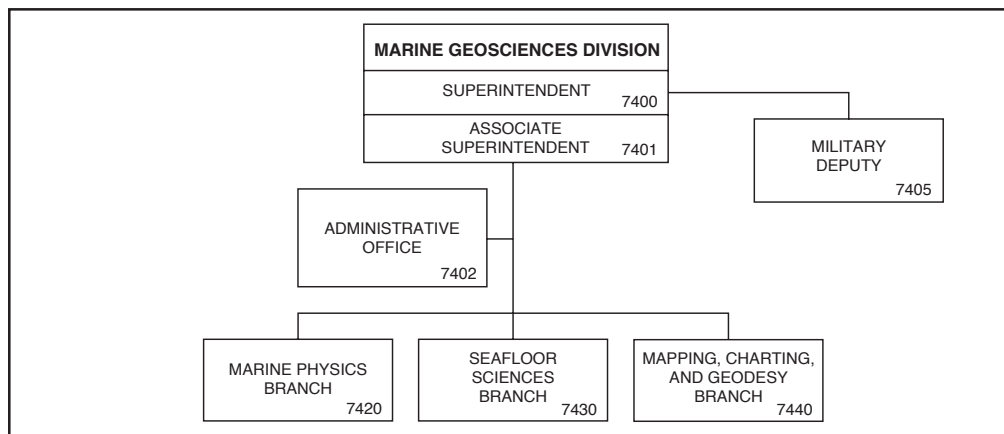
Lattice Fringe Comparison by EC-TEM



An image taken by NRL scientists using an environmental cell transmission electron microscope. The images demonstrate the effect of microbially mediated iron reduction on the crystal structure of clay minerals in marine environments (a, nonreduced; b, microbially reduced). The physiochemical properties of clays are important because they influence contaminant bioremediation and acoustical and optical properties in marine sediments.



Dr. H.C. EPPERT, JR.



Basic Responsibilities

The Marine Geosciences Division has responsibility for planning and executing a broad spectrum research, development, and technology program in marine geology, geophysics, geoacoustics, geotechniques, and geospatial information and systems (GIS). The program is designed to provide necessary digital data-bases, geoacoustic and geophysical models, and simulations to support training, system design, performance prediction, and operational needs of the Navy.

The applied portion of the program is directed toward (1) quantitatively predicting the effects of the seafloor and associated geophysical, geomorphological, and geoacoustic variability on performance of present and emerging naval systems, operations, and plans and (2) developing technology and techniques to rapidly acquire, process, and analyze MC&G (such as gravity, magnetics, and bathymetry) and other types of geological, geophysical, and geoacoustic information to meet existing digital database requirements of the Chief of Naval Operations (CNO), National Image and Mapping Agency (NIMA), and system commands.

The Division serves as the focal point in the Navy and Marine Corps for assessing and identifying MC&G requirements, including prototype digital MC&G products and product coordination. The program is keyed to and responsive to priorities identified by NRL, Office of Naval Research, CNO, the System Commands, NIMA, and Federal Homeland Defense programs. Close coordination and interaction with the Warfare Centers is essential to the success of this program with transition of Division products to system developers and the operational Navy a primary goal. The Division program is coordinated and interactive with other NRL programs and activities, ONR's Research Program Department, NOAA, USGS, NSF, and other government agencies involved in seafloor activities. The Division collaborates and cooperates with scientists from the academic community, other U.S. and foreign laboratories, and industry.

Personnel: 80 full-time civilian; 2 full-time military

Key Personnel		
Name	Title	Code
Dr. H.C. Eppert, Jr.	Superintendent	7400
	Associate Superintendent	7401
	Administrative Officer	7402
	Military Deputy	7405
	Head, Marine Physics Branch	7420
	Head, Seafloor Sciences Branch	7430
	Head, Mapping, Charting, and Geodesy Branch	7440

Point of contact: Code 7400, (228) 688-4650; DSN 828-4650

Marine Meteorology Division

Code 7500 Research Activity Areas

Numerical Weather Prediction

- Global
- Mesoscale
- On-scene
- Large eddy simulation
- Boundary layer
- Coastal
- Massively parallel computing
- Coupled ocean/atmosphere/wave
- Tropical cyclones
- Aerosols
- Topographically forced flow
- Predictability

Data Assimilation

- Optimum interpolation
- 3D and 4D variational analysis
- Quality control
- Synthetic soundings
- Remotely sensed data
- Physical initialization
- Direct radiance assimilation
- Radar data assimilation
- Targeted observations

Tactical Environmental Support

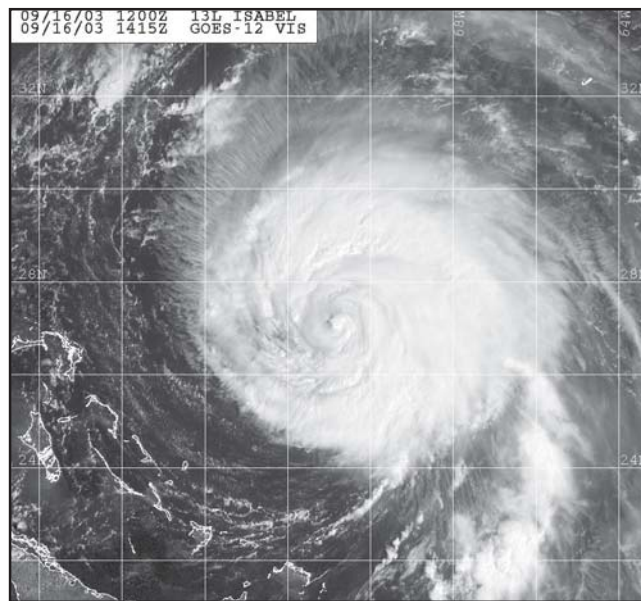
- Naval Integrated Tactical Environmental Subsystem
- Data fusion
- Nowcasting
- Visualization
- Port studies
- Typhoon havens
- Forecaster handbooks
- Expert systems

Satellite Data/Imagery

- Automated cloud classification
- Satellite imagery analysis
- Case study development
- Multisensor data fusion
- Tropical cyclone intensity
- Water vapor-tracked winds
- Cloud-tracked winds
- Dust/aerosols
- Rain rate

Decision Aids

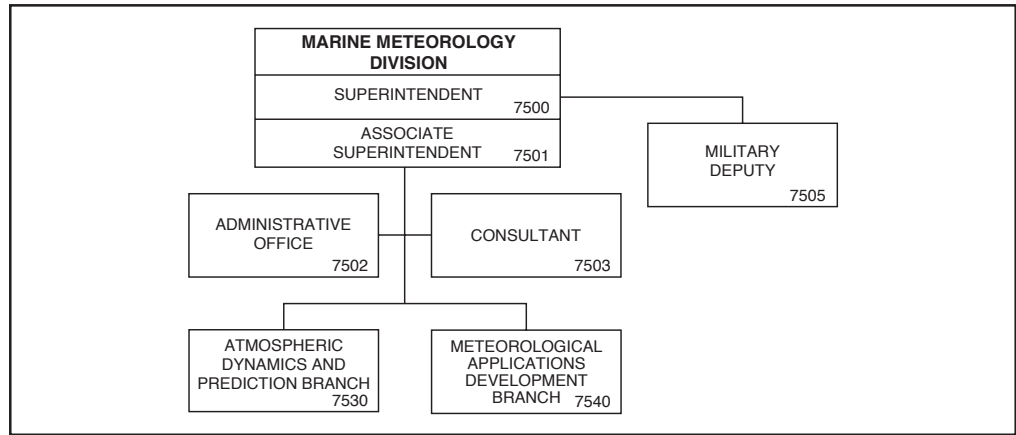
- Refractivity
- Ceiling/visibility
- Fog/turbulence/icing
- Electromagnetic propagation
- Electro-optical propagation
- Tropical cyclones



Visible image of Hurricane Isabel as it approaches the U.S. East Coast



DR. S.W. CHANG



Basic Responsibilities

The Marine Meteorology Division conducts a basic and applied research and development program designed to improve the basic understanding of atmospheric processes that impact Fleet operations and to develop information systems that analyze, simulate, predict, and interpret the structure and behavior of these processes and their effect on naval weapons systems. Basic research includes work in air-sea interaction, aerosol characterization, atmospheric turbulence, orographic and fetch-limited flow, atmospheric predictability, targeted observations, advanced data assimilation, and atmospheric physics. Applied research ranges from development of both central-site and on-scene analysis/forecast systems and satellite data products to the development of tactical decision aids for operations support. NRL-Monterey (NRL-MRY) is co-located with the Fleet Numerical Meteorology and Oceanography Center (FNMOC) and has developed and transitioned to FNMOC the data assimilation, global and mesoscale forecast models, and satellite applications products that form the backbone of the Navy's worldwide weather forecasting capability. In addition, NRL is transitioning similar products and capabilities to the Navy's regionalized meteorology and oceanography centers around the globe. Specialties of the Division include numerical weather prediction, data assimilation and quality control, marine boundary layer processes, aerosols, on-scene atmospheric environment assessment, environmental decision aids, database management, and satellite data interpretation and application.

Personnel: 69 full-time civilian; 2 full-time military

Key Personnel		
Name	Title	Code
Dr. S.W. Chang	Superintendent	7500
	Associate Superintendent	7501
	Administrative Officer	7502
	Military Deputy	7505
	Head, Atmospheric Dynamics and Prediction Branch	7530
	Head, Meteorological Applications Development Branch	7540

Point of contact: Code 7500, (831) 656-4721; DSN 878-4721

Space Science Division

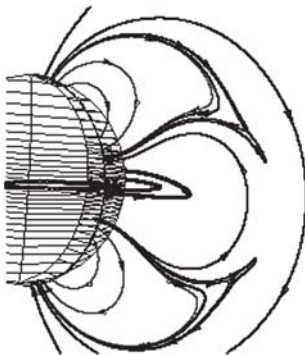
Code 7600 Research Activity Areas

Space Weather and Atmospheric Physics

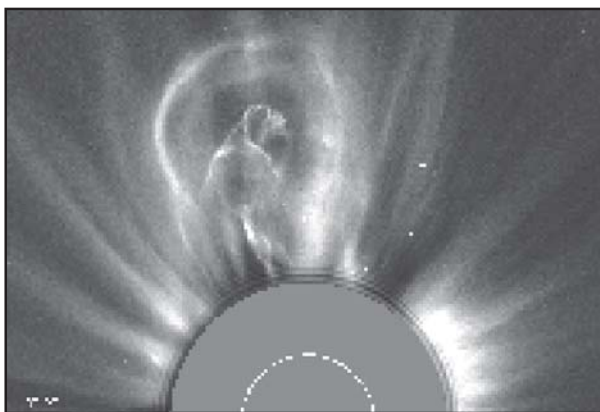
Remote sensing of the ionosphere and thermosphere
Middle atmospheric investigations
Global modeling
Upper atmospheric physics

Space Astronomy

X-ray observation, analysis, and theory of space astronomical sources
Gamma-ray astrophysics, solar-flare gamma rays, and space cosmic ray particle environment
Gamma-ray Large Area Space Telescope (GLAST) NASA space mission



The Solar Theory Group has simulated the overall magnetic field in the Sun's corona and demonstrated the formation of coronal mass ejections following field reconnection



A coronal mass ejection emerging from the Sun as a large, spherical region of hot gas and entrapped magnetic field

Solar Physics

Solar ultraviolet and visible light spectroscopy and photometry from rockets, satellites, and the Space Shuttle
Extreme-ultraviolet Imaging Spectrometer (EIS)
Sun Earth Connection Coronal and Heliospheric Investigation (SECCHI) for the Stereo Mission

Solar-Terrestrial Relationships

Solar X-ray/EUV plasma diagnostics; coronal effects on Earth



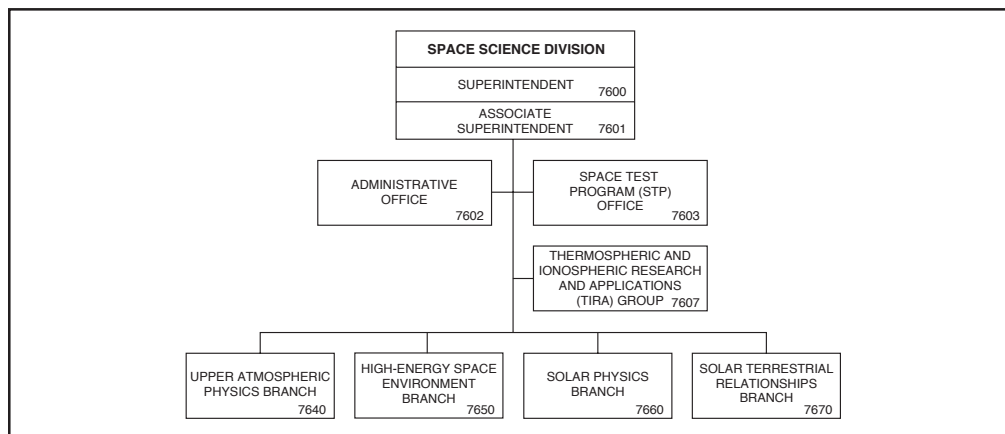
SHIMMER being readied for flight on the Space Shuttle. SHIMMER, a Michelson Interferometer, will map the globe in atmospheric trace compounds.



A Black Brant rocket being readied for flight at the White Sands Missile Range. The rocket is carrying NRL's advanced spectrometer for studying stars at soft X-ray wavelengths.



DR. H. GURSKY



Basic Responsibilities

The Space Science Division conducts research in the fields of astronomy and astrophysics, solar-terrestrial physics, and atmospheric science. Satellites, rockets, and ground-based facilities are used to obtain information on radiation from the Sun and celestial sources, and to study the behavior of the ionosphere and high atmosphere. Research results are of importance to radio communications, to use of the space environment, to weather prediction, and to the fundamental understanding of natural radiation and geophysical phenomena. The Superintendent also acts as Chief Scientist of the E.O. Hulburt Center for Space Research, created to provide research opportunities in space science to appointees from universities.

Personnel: 81 full-time civilian; 1 full-time military

Key Personnel		Code
Name	Title	
Dr. H. Gursky	Superintendent	7600
	Associate Superintendent	7601
	Administrative Officer	7602
	Space Test Program Officer, Kirtland AFB, NM	7603
	Thermospheric and Ionospheric Research and Applications (TIRA) Group	7607
	Head, Upper Atmospheric Physics Branch	7640
	Head, High-Energy Space Environment Branch	7650
	Head, Solar Physics Branch	7660
	Head, Solar Terrestrial Relationships Branch	7670

Point of contact: Code 7602, (202) 767-3631

**Naval Center
for Space
Technology**

NAVAL CENTER FOR SPACE TECHNOLOGY

Code 8000

In its role to preserve and enhance a strong space technology base and provide expert assistance in the development and acquisition of space systems that support naval missions, the Naval Center for Space Technology activities extend from basic and applied research through advanced development in all areas of interest to the Navy space program. These activities include developing spacecraft, systems using these spacecraft, and ground command and control stations. Principal functions of the Center include understanding and clarifying requirements, recognizing and prosecuting promising research and development, analyzing and testing systems to quantify their capabilities, developing operational concepts

that exploit new technical capabilities, system engineering to allocate design requirements to subsystems, and engineering development and initial operation to test and evaluate selected spacecraft subsystems and systems. The Center is a focal point and integrator for those divisions at NRL whose technologies are used in space systems. The Center also provides systems engineering and technical direction assistance to system acquisition managers of major space systems. In this role, technology transfer is a major goal and motivates a continuous search for new technologies and capabilities and the development of prototypes that demonstrate the integration of such technologies.

Director of Naval Center for Space Technology

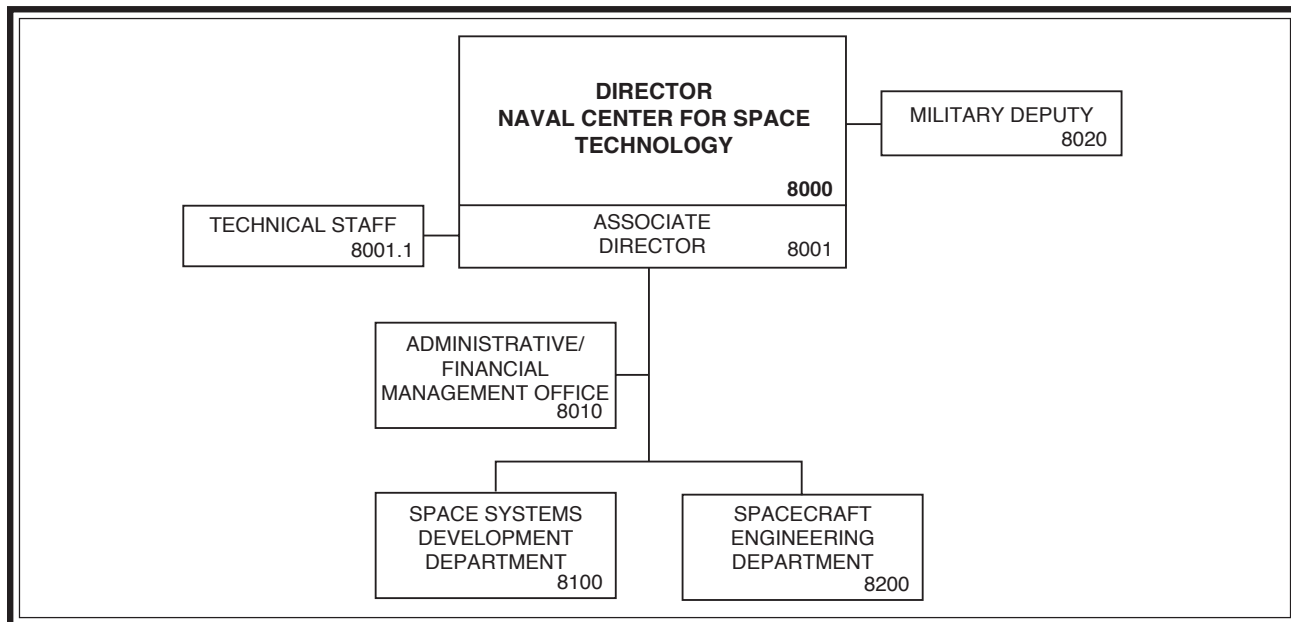


Mr. P.G. Wilhelm was born in New York City on July 26, 1935. He attended Purdue University, where he received a B.S.E.E. degree in 1957. By 1961, he had completed all the course work for an M.S.E. degree from George Washington University.

From 1957 to 1959, Mr. Wilhelm served as an electrical engineer with Stewart Warner Electronics where he was assigned to a project to redesign the UPM-70, a Navy radar test set. In March 1959, he joined the Naval Research Laboratory as an electrical scientist in the Electronics Division. In December 1959, he joined the Satellite Techniques Branch. In 1961, he became Head of the Satellite Instrument Section; in 1965, he

became Head of the Satellite Techniques Branch; and in 1974, Head of the Spacecraft Technology Center. In these positions, he performed satellite system design, equipment development, environmental testing, launch operations, and orbital data handling. In 1981, he was named the Superintendent of the Space Systems and Technology Division, the Navy's principal organization, or lead Laboratory, for space. He is credited with contributions in the design, development, and operation of more than 85 scientific and Fleet-support satellites. He has been awarded five patents. In October 1986, he was appointed Director of the newly established Naval Center for Space Technology. The Center's mission is to "preserve and enhance a strong space technology base and provide expert assistance in the development and acquisition of space systems which support naval missions."

Mr. Wilhelm has been recognized with numerous awards including the Navy's Meritorious Civilian Service Award, the DoD Distinguished Civilian Service Award, the Presidential Meritorious Executive Award, the Presidential Distinguished Rank Award, the Institute of Electrical and Electronics Engineers Aerospace and Electronic Systems Group Man of the Year Award, the NRL E.O. Hulburt Annual Science and Engineering Award, the Dexter Conrad Award, the Rotary National Stellar Award, the NRL Lifetime Achievement Award, and in May 1999, Mr. Wilhelm received the American Institute of Aeronautics and Astronautics (AIAA) Goddard Astronautics Award. He also has been elected a Fellow of the Washington Academy of Sciences and a Fellow of the American Institute of Aeronautics and Astronautics, and was elected to the National Academy of Engineering. Mr. Wilhelm is also the first recipient of the R.L. Easton Award for excellence in engineering.



Key Personnel		
Name	Title	Code
Mr. P.G. Wilhelm	Director, Naval Center for Space Technology	8000
	Associate Director	8001
	Technical Staff	8001.1
	Head, Administrative / Financial Management Office	8010
Mr. R.E. Eisenhower	Military Deputy	8020
	Superintendent, Space Systems Development Department	8100
	Superintendent, Spacecraft Engineering Department	8200
Mr. J.P. Schaub*		

Point of contact: Code 8001, (202) 767-6549

*Acting

Space Systems Development Department

Code 8100 Research Activity Areas

Advanced Space Systems Technologies

- Space systems architectures and requirements
- Advanced payloads and optical communications
- Controllers, processors, signal processing, and VLSI
- Data management systems and equipment
- Embedded algorithms and software
- Satellite laser ranging

Astrodynamics

- Precision orbit estimation
- Onboard autonomous navigation
- Star catalog development
- Onboard orbit propagation
- GPS space navigation
- Satellite coverage and mission analysis
- Geolocation systems
- Orbit dynamics
- Interplanetary navigation

Command, Control, Communications, Computers, and Intelligence

- Communications theory and systems
- Tracking, telemetry, and control systems
- Satellite ground station engineering and implementation
- Transportable and fixed ground antenna systems
- High-speed fixed and mobile ground data collection, processing, and dissemination systems
- Tactical communication systems



The Windsat payload demonstrates a new capability to measure wind direction over the oceans from space using passive polarimetric radiometry. The successful development and airborne demonstration of the technique by NRL's Remote Sensing Division led to the approval of a joint Navy and Air Force space demonstration program. Windsat is a risk reduction and technology demonstration program for the National Polar-orbiting Operational Environmental Satellite System (NPOESS).

Space Electronic Systems Development

- Space system concept definition, design, and implementation including hardware and software
- Detailed electrical/electronic design of electronic and electromechanical systems and components
- Design and verification of real-time embedded multiprocessor software
- Spacecraft antenna systems
- Space systems fabrication, test, and integration
- Launch and on-orbit support

Space Electronic Warfare

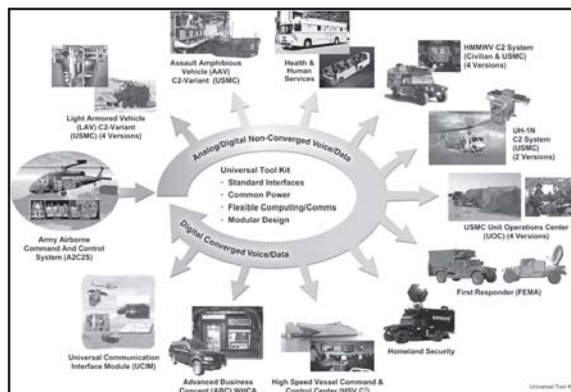
- Design criteria for counter-surveillance and counter-targeting
- Data search, analysis, and synthesis of information related to special sensor performance

Space Mission Development

- Mission development and requirements definition
- Systems engineering and analysis
- Concepts of operations and mission simulations
- Mission evaluation and performance assessments

Space Surveillance, Navigation, and Time

- Advanced navigation satellite technology
- Precise Time and Time Interval (PTTI) technology
- Atomic-time/frequency standards/instrumentation
- Passive and active ranging techniques
- Detection and precision tracking of orbiting objects from space and ground

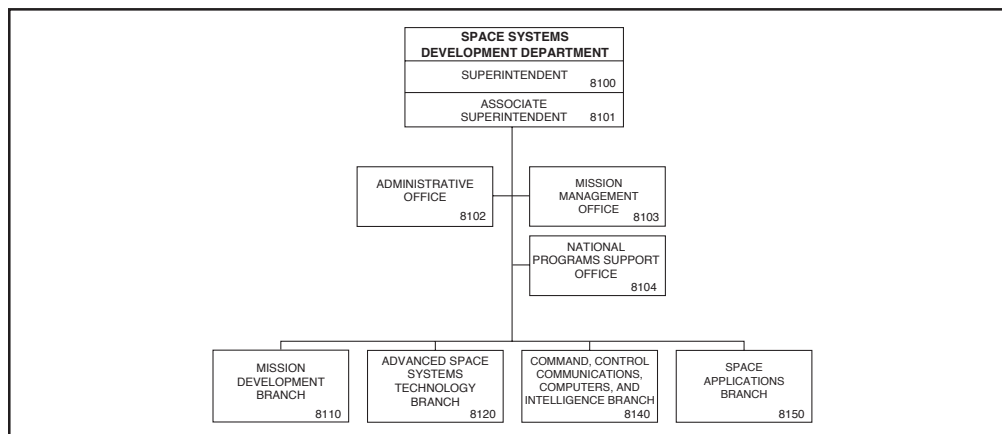


Over the last couple years, the Tactical Technologies Development Laboratory has implemented over 26 different mobile command and control systems for a variety of sponsors. Code 8140 has modularized all of the components of command and

control into the Universal Toolkit for mobile command and control after the development of the Army Airborne Command and Control System (A2C2S). These generic building blocks have made it possible to build new C2 systems in weeks as opposed to months and even years. Systems have been employed for both civilian and military organizations. These advanced prototypes have progressed from discrete analog systems into the digital, converge network approach for seamless end-to-end connectivity. The technologies of the Universal Toolkit have migrated from prototype to operationally deployed systems in the High Speed Vessel (HSV-X1), Federal Emergency Management Agency (FEMA), and the White House.



Mr. R.E. EISENHAUER



Basic Responsibilities

The Space Systems Development Department (SSDD) is the space and ground support systems research and development organization of the Naval Center for Space Technology. The primary objective of the SSDD is to develop space systems to respond to Navy, DoD, and national mission requirements with improved performance, capacity, reliability, efficiency, and/or life cycle cost. The Department must derive system requirements from the mission, develop architectures in response to these requirements, and design and develop systems, subsystems, equipment, and implementation technologies to achieve the optimized, integrated operational space and ground system. These development responsibilities extend across the entire space/ground spectrum of hardware, software, and advanced technologies, including digital processing and control, analog systems, power, communications, command and telemetry, radio frequency, optical, payload, and electromechanical systems, as well as systems engineering.

Personnel: 147 full-time civilian; 2 part-time civilian; 15 student civilian; 1 intermittent civilian

Key Personnel		
Name	Title	Code
Mr. R.E. Eisenhauer	Superintendent	8100
	Associate Superintendent	8101
	Administrative Officer	8102
	Head, Mission Management Office	8103
	Head, National Programs Support Office	8104
	Head, Mission Development Branch	8110
	Head, Advanced Space Systems Technology Branch	8120
	Head, Command, Control, Communications, Computers, and Intelligence Branch	8140
	Head, Space Applications Branch	8150

Point of contact: Code 8102, (202) 767-0432

Spacecraft Engineering Department

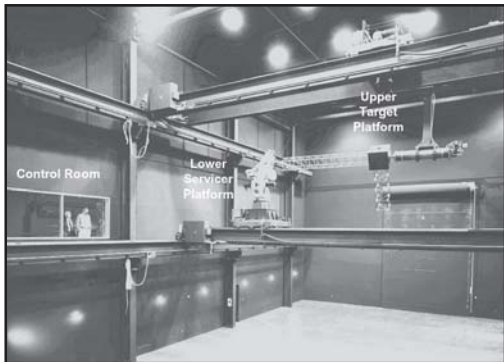
Code 8200 Research Activity Areas

Design, Test, and Processing

Design, fabrication, and testing of spacecraft and hardware
Preliminary and detailed design, fabrication, testing, and integration onto launch vehicle
Systems engineering for new spacecraft proposals
Start-to-finish responsibility for NCST spacecraft mechanical systems

Systems Analysis

Research and development in spacecraft technology
Conceptual design trade studies
Integrated engineering design and analysis
Structural and thermal analysis
Development and transition of prototype hardware
Development and integration of experimental payloads



The Spacecraft Robotics Engineering and Controls Laboratory employs two six degree-of-freedom robotic manipulators to perform realistic orbital and attitude motion simulations for proximity operations of spacecraft. This facility enables hardware-in-the-loop testing of machine vision systems, capture mechanisms and autonomous guidance, navigation, and control algorithms. The resulting technologies will benefit future DoD space missions involving autonomous rendezvous and capture.

The Naval Research Laboratory and DoD's Office of Force Transformation are working on the development and experimentation of a low-cost tactical microsat system, with emphasis on producing operationally relevant capabilities. Touch-stones for this effort include quick response and Joint Task Force (JTF) organic, selectable payloads at UAV cost factors that can cover potential military conflicts at any location on Earth. The space asset is organic in that the JTF Commander decides:

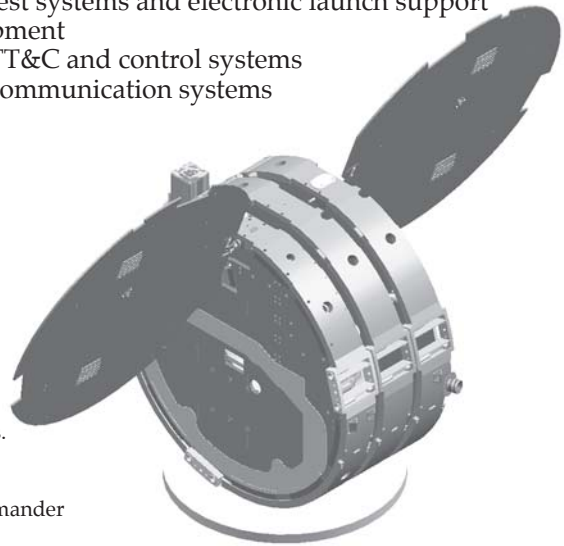
(1) payload capability needed, (2) area of interest, (3) area for direct downlink, and (4) when to call up asset, and submits spacecraft tasking to and pulls data from the SIPRNET. TacSat-1 has several payloads, providing capabilities for cross-platform missions, visible and IR imaging, and specific emitter identification. TacSat-1 is currently under construction and is scheduled for 2nd Quarter FY04 launch, a schedule that is less than one year from authorization to proceed.

Control Systems

Attitude determination and control systems
Reaction control
Precision pointing
Optical line-of-sight stabilization
Propulsion systems
Analytical design and mission planning
Navigation, tracking, and orbit dynamics
Expert systems
Flight operations support
Computer simulation
Computer animation
Robotics engineering and control
Spaceborne robotics applications
Autonomous rendezvous and capture

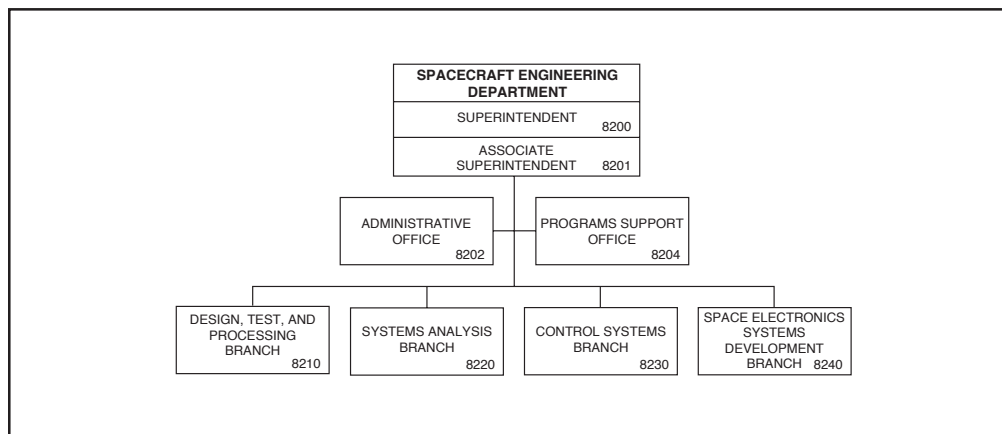
Space Electronic Systems Development

Space system concept definition, design, and implementation including hardware and software
Detailed electrical/electronic design of electronic and electromechanical systems and components
Implementation of real-time flight software and embedded command, control, and telemetry software
Design and verification of real-time embedded multi-processor software
Spacecraft antenna systems
Space systems fabrication, test, and integration
Launch and on-orbit support
Space test systems and electronic launch support equipment
Space TT&C and control systems
Space communication systems





Mr. J.P. SCHAUB*



Basic Responsibilities

The Spacecraft Engineering Department (SED) is the focal point for the Navy's capability to design and build spacecraft. Activities range from concept and feasibility planning to on-orbit IOC for NRL's space systems.

The SED provides spacecraft bus expertise for the Navy and maintains an active in-house capability to develop satellites; manages Navy space programs through engineering support and technical direction; in concert with the Space Systems Development Department, designs, assembles and tests spacecraft and space experiments, including all aspects of space, launch, and ground support; analyzes and designs structures, mechanisms, and a variety of control systems, including attitude, propulsion, reaction, and thermal; integrates satellite designs, launch vehicles, and satellite-to-boost stages; functions as a prototype laboratory to ensure that designs can be transferred to industry and incorporated into subsequent satellite hardware builds; and consults with the Navy Program Office on technical issues involving spacecraft architecture, acquisition, and operation.

Personnel: 105 full-time civilian; 3 part-time civilian; 10 student civilian; 2 intermittent civilian

Key Personnel		
Name	Title	Code
Mr. J.P. Schaub*	Superintendent	8200
	Associate Superintendent	8201
	Administrative Officer	8202
	Head, Programs Support Office	8204
	Head, Design, Test, and Processing Branch	8210
	Head, Systems Analysis Branch	8220
	Head, Control Systems Branch	8230
	Head, Space Electronics Systems Development Branch	8240

Point of contact: Code 8200, 767-6411

*Acting

Technical Output, Fiscal, and Personnel Information

Technical Output

Publications, Presentations, and Patents

The Navy continues to be a pioneer in initiating new developments and a leader in applying these advancements to military requirements. The primary means of informing the scientific and engineering community of the advances made at NRL is through the Laboratory's technical output—reports, articles in scientific journals, contributions to books, papers presented to scientific societies, and topical conferences, patents, and inventions.

The figures for calendar years 2002, 2003, and 2004 presented below represent the output of NRL facilities in Washington, DC; Bay St. Louis, Mississippi; and Monterey, California.

In addition to the output listed, NRL scientists made more than 680 oral presentations during 2002, 771 oral presentations during 2003, and 900 oral presentations during 2004.

In 1986, Congress enacted the Federal Technology Transfer Act in an effort to encourage the commercial use of technology developed in Federal laboratories. The Act allows Government inventors and the laboratories where they work to share the royalties generated by commercial licensing of their inventions. Also, the Act encourages the establishment of cooperative research and development agreements between laboratories such as NRL and nonfederal entities such as state and local governments, universities, and business corporations. Such cooperative R&D agreements can include the allocation in advance of patent rights on any inventions made under the joint research effort.

The 1986 Act has given additional impetus to the Laboratory's efforts to patent important inventions arising out of its various research programs.

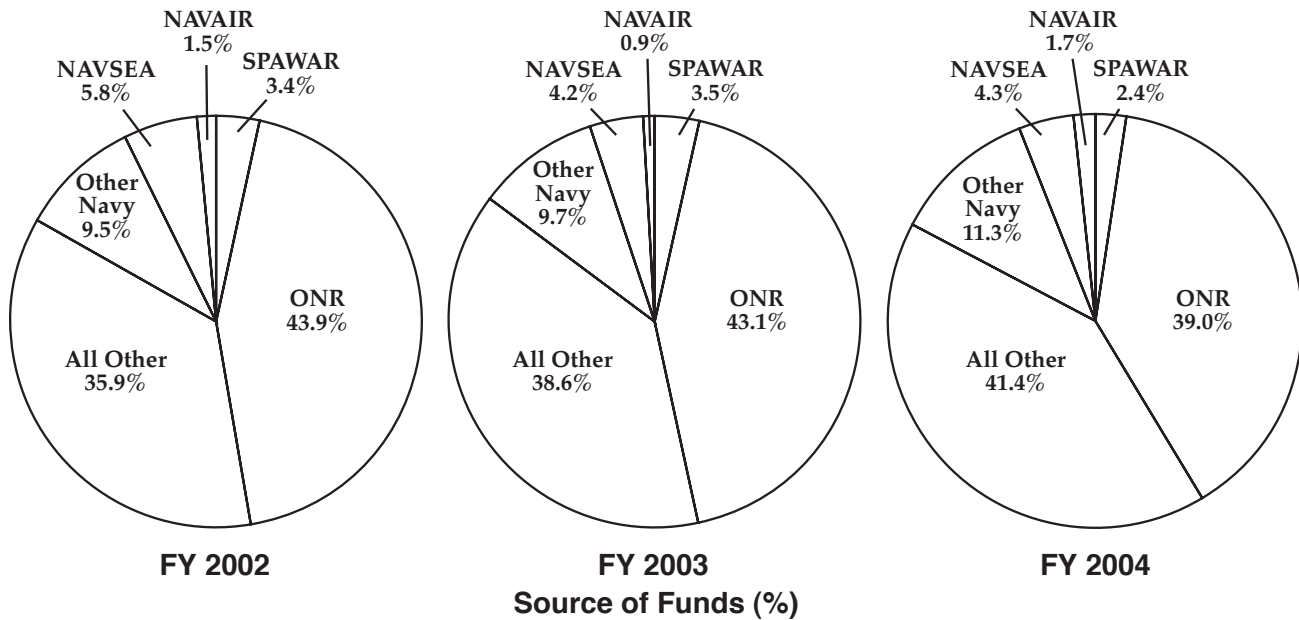
Type of Contribution	Calendar Year 2002		Total
	Unclassified	Classified	
Articles in periodicals, chapters in books, and papers in published proceedings	1,104	0	1,104*
NRL Formal Reports	22	4	26
NRL Memorandum Reports	60	2	62
Books	0	0	0
Patents granted			81
Statutory Invention Registrations (SIRs)			3
Type of Contribution	Calendar Year 2003		Total
	Unclassified	Classified	
Articles in periodicals, chapters in books, and papers in published proceedings	1,084	0	1,084**
NRL Formal Reports	17	2	19
NRL Memorandum Reports	77	1	78
Books	5	0	5
Patents granted			63
Statutory Invention Registrations (SIRs)			2
Type of Contribution	Calendar Year 2004		Total
	Unclassified	Classified	
Articles in periodicals, chapters in books, and papers in published proceedings	1,182	0	1,182***
NRL Formal Reports	21	5	26
NRL Memorandum Reports	76	6	82
Books	3	0	3
Patents granted			83
Statutory Invention Registrations (SIRs)			0

* This is a provisional total based on information available to the Ruth H. Hooker Research Library on January 21, 2003. Additional publications carrying a 2002 publication date are anticipated.

** This is a provisional total based on information available to the Ruth H. Hooker Research Library on February 26, 2004. Additional publications carrying a 2003 publication date are anticipated.

*** This is a provisional total based on information available to the Ruth H. Hooker Research Library on February 23, 2005. Additional publications carrying a 2004 publication date are anticipated.

FY 2002/2003/2004 Sources of New Funds (Actual)

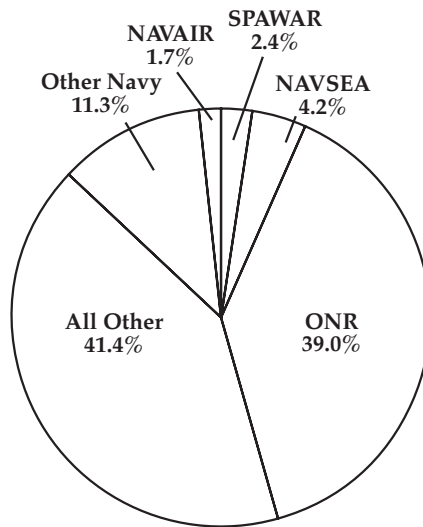


FY 2002		\$M		
		Reimbursable	Direct Cite	Total
Office of Naval Research (ONR)		263.2	82.8	346.0
Naval Sea Systems Command (NAVSEA)		34.7	11.4	46.1
Space and Naval Warfare Systems Command (SPAWAR)		19.9	7.3	27.2
Naval Air Systems Command (NAVAIR)		3.5	8.2	11.7
Other Navy		48.5	26.4	74.9
All Other		<u>187.3</u>	<u>95.6</u>	<u>282.9</u>
Total Funds		557.1	231.7	788.8

FY 2003		\$M		
		Reimbursable	Direct Cite	Total
Office of Naval Research (ONR)		272.2	92.3	364.5
Naval Sea Systems Command (NAVSEA)		20.4	15.3	35.7
Space and Naval Warfare Systems Command (SPAWAR)		22.5	6.8	29.3
Naval Air Systems Command (NAVAIR)		4.1	3.5	7.6
Other Navy		56.3	25.6	81.9
All Other		<u>232.2</u>	<u>93.5</u>	<u>325.7</u>
Total Funds		607.7	237.0	844.7

FY 2004		\$M		
		Reimbursable	Direct Cite	Total
Office of Naval Research (ONR)		235.7	92.3	328.0
Naval Sea Systems Command (NAVSEA)		14.5	21.5	36.0
Space and Naval Warfare Systems Command (SPAWAR)		15.2	4.8	20.0
Naval Air Systems Command (NAVAIR)		3.1	11.4	14.5
Other Navy		66.5	28.4	94.9
All Other		<u>253.0</u>	<u>95.4</u>	<u>348.4</u>
Total Funds		588.0	253.8	841.8

FY 2005 Sources of New Funds (Plan)

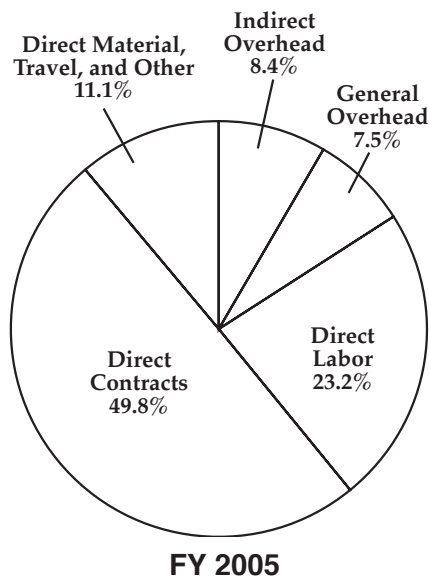


**FY 2005
Source of Funds (%)**

FY 2005*	\$M		Total
	Reimbursable	Direct Cite	
Office of Naval Research (ONR)	247.8	92.2	340.0
Naval Sea Systems Command (NAVSEA)	15.3	21.4	36.7
Space and Naval Warfare Systems Command (SPAWAR)	15.9	4.8	20.7
Naval Air Systems Command (NAVAIR)	3.2	11.5	14.7
Other Navy	69.9	28.4	98.3
All Other	<u>265.9</u>	<u>95.4</u>	<u>361.3</u>
Total Funds	618.0	253.7	871.7

*Source FY 2005 Column of FY 2006 President's Budget (1 / 05).

FY 2005 Distribution of New Funds (Plan)

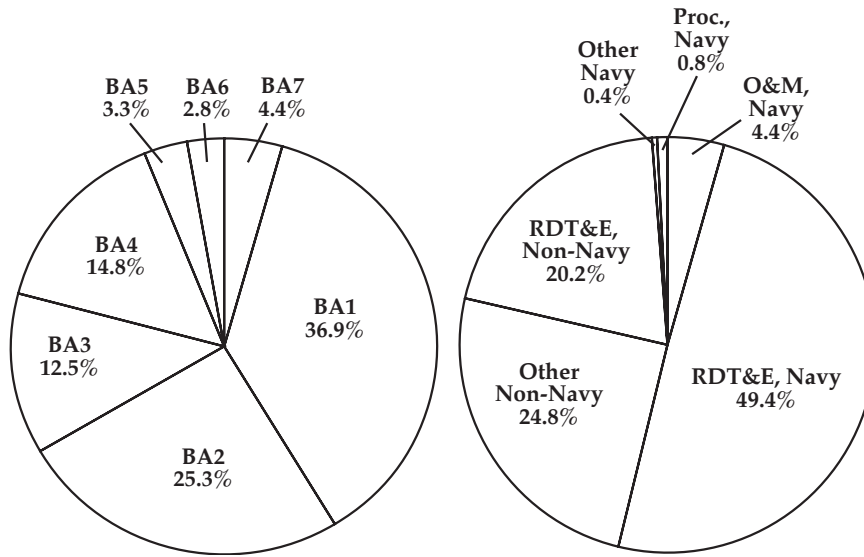


Distribution of Funds (%)

	\$M
Direct Labor	196.3
General Overhead	64.0
Indirect Overhead	71.4
Direct Material, Travel, and Other	94.0
Direct Contracts*	<u>422.3</u>
Total Funds	848.0

*Direct contracts include reimbursable and direct citation funding. Source: FY 2005 Column of FY 2006 President's Budget (1/05).

FY 2005 Reimbursable New Funds by Category (Plan)



FY 2005

Distribution of RDT&E, Navy (%)
(\$305.3)

Distribution of Reimbursable (%)
(\$618.0)

Category	Navy	\$M Non-Navy	Total
6.1 Basic Research	112.6	3.4	116.0
6.2 Applied Research	77.3	22.2	99.5
6.3 Advanced Technology Development	38.0	55.6	93.6
6.4 Demonstration and Validation	45.2	10.4	55.6
6.5 Engineering and Manufacturing Development	10.1	1.7	11.8
6.6 RDT&E Management Support	8.5	10.4	18.9
6.7 Operational System Development	<u>13.4</u>	<u>20.9</u>	<u>34.3</u>
Subtotal RDT&E	305.3	124.6	429.9
Operations and Maintenance	27.1	5.9	33.0
Procurement	5.3	28.6	33.9
Other	<u>2.6</u>	<u>118.6</u>	<u>121.2</u>
Total Reimbursable Funds	340.3	277.7	618.0

*Source: FY 2005 Column of FY 2006 President's Budget (1/05).

Personnel Information*

Civilian

Full-Time, Permanent (FTP)

Graded	2,298
Ungraded	<u>98</u>
Total	2,396

Temporary, Part-Time, Intermittent (TPTI)

TPTI	<u>295</u>
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Total Civilian 2,691

FTP Breakdown

Scientific/Engineering Professional	1,518
Scientific/Engineering Technical	104
Administrative Specialist/Professional	357
Administrative Support	279
Senior Executive Service	23
Scientific or Professional	17
General Schedule	<u>0</u>
Total	2,298

Civilian Budgeted

End-Strength 2,618**

Military

Officers	35
Enlisted	<u>80</u>

Total Military On-Board 115

Military Allowance 122

On-Board	Total Military	Total Civilian	FTP	TPTI	FTP Ungraded	FTP Graded
2,806	115	2,691	2,396	295	98	2,298

Annual Civilian Turnover Rate (%) (permanent employees only)

	1999	2000	2001	2002	2003
Research divisions	11.62	10.02	10.9	6.1	6.0
Nonresearch areas	18.14	10.85	9.0	8.9	8.2
Entire Laboratory	12.89	10.18	10.5	6.6	6.4

Highest Academic Degrees Held by Permanent Employees

Bachelors	563
Masters	364
Doctorates	812

* Military numbers are current as of 30 September 2004.

** Civilian Budgeted End-Strength number as reflected in the FY 2004 column of the FY 2005 President's Budget (ES subject to ceiling). Numbers current as of September 30, 2004; figures include all NRL sites.

**Professional
Development**

Professional Development

NRL has established programs for the professional and personal development of its employees so that they may better serve the needs of the Navy. These programs develop and retain talented people and keep them abreast of advanced technology and management skills. Graduate assistantships, fellowships, sabbatical study programs, cooperative education programs, individual college courses, and short courses for personal improvement contribute to professional development.

Programs also exist for non-NRL employees. These programs enhance research efforts by providing means for non-NRL professionals to work at the Laboratory, thereby improving the interchange of ideas, meeting critical short-term technical requirements, and providing sources for new scientists and engineers. The programs include two-year graduate fellowships, faculty and professional interchanges, undergraduate work, and introducing gifted and talented high school students to the world of technology.

Programs for NRL Employees

NRL employees participate in hundreds of individual training events throughout the year. Many of these are presented under the auspices of the Human Resources Office as in-house courses on diverse technical subjects, computer software, and management techniques.

One common study procedure is for employees to work full time at the Laboratory while taking job-related scientific courses at universities and schools in the Washington area. The training ranges from a single course to full graduate-level programs. Tuition for training is paid by NRL. The formal programs offered by NRL are described below.

Graduate Programs

- The **Advanced Graduate Research Program** (formerly the Sabbatical Study Program, which began in 1964) enables selected professional employees to devote full time to research or pursue work in their own or a related field for one year at an institution or research facility of their choice without the loss of regular salary, leave, or fringe benefits. NRL pays all educational costs, travel, and moving expenses for the employee and dependents. Criteria for eligibility include professional stature consistent with the applicant's opportunities and experience, a satisfactory program of study, and acceptance by the facility selected by the applicant. The program is open to paraprofessional (and above) employees who have completed six years of Federal service, four years of which are required at NRL.

- The **Edison Memorial Graduate Training Program** enables employees to pursue advanced studies in their fields at local universities. Participants in this program work 24 hours each work-week and pursue their studies during the other 16 hours. The criteria for eligibility include a minimum of one year of service at NRL, a bachelor's or master's degree in an appropriate field, and profes-

sional standing in keeping with the candidate's opportunities and experience.

- To be eligible for the **Select Graduate Training Program**, employees must have a college degree in an appropriate field and must have demonstrated ability and aptitude for advanced training. Students accepted in this program devote a full academic year to graduate study. While attending school, they receive one half of their salary; and NRL pays for tuition, books, and laboratory expenses.

- The **Naval Postgraduate School (NPS)**, located in Monterey, California, provides graduate programs to enhance the technical preparation of Naval officers and civilian employees who serve the Navy in the fields of science, engineering, operations analysis, and management. It awards a master of arts degree in national security affairs and a master of science degree in many technical disciplines.

NRL employees desiring to pursue graduate studies at NPS may apply for a maximum of six quarters away from NRL, with thesis work accomplished at NRL. Specific programs are described in the NPS catalog. Participants continue to receive full pay and benefits during the period of study.

- Research conducted at NRL may be used as thesis material for an advanced degree.

This original research is supervised by a qualified employee of NRL who is approved by the graduate school. The candidate should have completed the required course work and should have satisfied the language, residence, and other requirements of the graduate school from which the degree is sought. NRL provides space, research facilities, and supervision but leaves decisions on academic policy to the cooperating schools.

Professional Development

NRL has programs, professional society chapters, and informal clubs that enhance the professional growth of employees. Some of these are listed below.

- The **Congressional Fellowship Program**, sponsored by the American Political Science Association, provides an opportunity for some of the most promising young, technically oriented Federal executives to participate in a variety of assignments designed to develop their knowledge and understanding of Congressional operations. These Fellows share activities with other members of the Congressional Fellowship Program who come mainly from journalism, law, and college teaching.

- The **LEGIS Fellows Program** provides assignments for personnel whose current or prospective positions may require working knowledge of the operations of the Congress. The Fellows receive instruction and hands-on experience in a Congressional office through training/developmental activities such as seminars, intensive briefings, and assignments on the staff of a member, committee, or support agency of the Congress in Washington, DC.

- The **Counseling Referral Service (C/RS)** helps employees to achieve optimal job performance through counseling and resolution of problems such as family, stress and anxiety, behavioral, emotional, and alcohol- or drug-related problems that may adversely impact job performance.

C/RS provides confidential assessments and short-term counseling, as well as training workshops and referrals to additional resources in the community. (Contact (202) 767-6857, NRL Washington, DC; (228) 688-5726, NRL Stennis Space Center; 1-800-523-5668, NRL Monterey).

- The **NRL Women in Science and Engineering (WISE) Network** is an open-membership network group of scientists and engineers who meet periodically to discuss issues of common interest, host speakers, address and sponsor projects to benefit NRL's S&T community. The primary goals

of the NRL WISE network, a merger of the NRL Women's S&T Network and the NRL WISE Chapter, are to encourage and promote professional growth among NRL scientists and engineers. One of the most successful projects initiated and sponsored by this group is the Mentor Program, which was institutionalized to provide an environment for personal and professional growth at NRL. The most recent project adopted by the **NRL WISE Network** group has focused on addressing issues concerning the quality of life for scientists and engineers at NRL. The idea was suggested by one of the invited speakers, Ms. Welch, who was DoD's Chief of Human Resources. The **NRL WISE Network** jointly with the NRL Mentor Program has launched a new seminar series focused on NRL, Navy, and DoD research organizations. A reception, hosted by the **NRL WISE Network** group, immediately follows the seminar and is held at the Science Lounge in Building 222.

Members of the **NRL WISE Network** meet regularly at noon on the first Friday of each month (September through June) at the Science Lounge in Building 222. These brown bag luncheon meetings are open to all NRL female and male scientists and engineers, including contractors and postdoctoral associates. If you would like to join the group and/or be on the electronic mailing list in order to be notified of events and topics of interest, please contact **NRL WISE Network** at (202) 404-6052. For inquiry and further information, the president of the **NRL WISE Network**, can be reached at (202) 404-4143.

- **Sigma Xi**, the Scientific Research Society, encourages and acknowledges original investigation in scientific research. As an honor society for research scientists, individuals who have demonstrated the ability to perform original research are elected to membership in local chapters. The NRL-Edison Chapter, comprised of several hundred members, recognizes leadership research at NRL by presenting awards annually in pure and applied science to outstanding NRL staff members. This year the chapter has initiated a Young Investigator Award to be presented to an outstanding young NRL researcher. The NRL-Edison Chapter also sponsors lectures at NRL on a wide range of scientific topics for the entire NRL community. These lectures are delivered by scientists from all over the nation and the world. The highlight of the Sigma Xi lecture series is the Edison Memorial Lecture, traditionally featuring a Nobel laureate. (Contact (202) 767-3934.)

- The **NRL Mentor Program** was established to provide an innovative approach to professional and career training and an environment for personal

and professional growth. It is open to all NRL employees in all job series and at all sites. Mentorees are matched with successful, experienced colleagues with more technical and/or managerial experience, who can provide them with the knowledge and skills needed to maximize their contribution to the success of their immediate organization, to NRL, to the Navy, and to their chosen career fields. The ultimate goal of the program is to increase job productivity, creativity, and satisfaction through better communication, understanding, and training. NRL Instruction 12400.1 established the NRL Mentor Program, and it provides the policy and procedures for the program. (Contact (202) 767-2957.)

- The Charlotte Moore-Sitterly Chapter of **Federally Employed Women, Inc. (FEW)** was chartered at NRL in 1993. FEW is an international organization of federally employed women and men whose purpose is to eliminate sex discrimination and sexual harassment and enhance career opportunities for women in government. FEW works closely with other Federal agencies and organizations, including the Office of Personnel Management, Equal Employment Opportunity Commission, and Federal Women's Program subcommittees. (Contact (202) 767-3846.)

- Employees interested in developing effective self-expression, listening, thinking, and leadership potential are invited to join either of two NRL chapters of **Toastmasters International**, the Thomas Edison Club or the Forum Club. Members of these clubs, who possess diverse career backgrounds and talents, learn to communicate not by rules but by practice in an atmosphere of understanding and helpful fellowship. NRL's Commanding Officer and the Director of Research endorse Toastmasters. (Thomas Edison Club: contact (202) 767-3782; Forum Club: contact (202) 767-4389.)

Continuing Education

NRL employees take government sponsored college courses (undergraduate and graduate) in order to improve their skills and keep abreast of current developments in their fields.

- The Human Resources Office (HRO) at NRL offers to all employees **short courses** in certain program areas that are not available at local schools; Laboratory employees may attend these courses at nongovernment facilities as well. Interagency courses in management, personnel, finance, supervisory development, clerical skills, and other areas are also available.

Other Programs

- The **Brookings Institution** offers a variety of seminars and conferences devoted to research, education, and publication on important issues of domestic and foreign policy.

- OPM's **Management Development Center** offers one- and two-week courses in intensive policy and management training for government managers and executives.

- The **Excellence in Government Fellows Program** is an extensive, year-long leadership development opportunity to build the capacity of mid-level federal managers to lead organizations and produce results. As part of their fellowship year, participants develop strategies for meeting the complex challenges facing their organizations.

Technology Base

- The **Scientist-to-Sea Program (STSP)** provides increased opportunities for Navy R&D laboratory/center personnel to go to sea for several days to gain first-hand insight into operational factors affecting system design, performance, and operations on a variety of ships.

For further information on the Technology Base Programs, contact Code 5006, (202) 767-3666.

Equal Employment Opportunity (EEO) Programs

Equal Employment Opportunity is a fundamental NRL policy for all persons, regardless of race, color, sex, religion, national origin, age, or physical/mental handicap. The EEO office's major functions include affirmative action in employment, discrimination complainant process, EEO training, advice and guidance to management on EEO policy, and the following special emphasis programs: the Federal Women's Program, the Hispanic Employment Program, the African-American Employment Program, the Individuals with Disabilities Employment Program, the Asian-American/Pacific Islander Employment Program, and the American Indian-Alaskan Native Employment Program.

The management and planning of diversity issues and the special emphasis programs are accomplished through the NRL Diversity Committee. The Diversity Committee serves as an advisory committee to the Commanding Officer and recommends policies, programs and activities, that encourage advancement and self-improvement for all employees. The committee educates NRL employees on diversity issues by sponsoring awareness programs and special workshops on quality of life issues pertaining to women, minorities, and persons with disabilities. They also aid in

Community Outreach efforts. (Contact the EEO Office at (202) 767-2486 for all EEO programs).

In addition, the EEO Office handles the Federal Employment Opportunity Recruitment Program (FEORP). The FEORP is designed to establish, maintain, and update targeted recruitment programs to reduce the conspicuous absence or manifest imbalance categories of NRL employees through innovative internal and external recruitment. Furthermore, it fosters relationships with minority and women's institutions and organizations.

Other Activities

- The **Community Outreach Program** traditionally has used its extensive resources to foster programs that provide benefits to students and other community citizens. Volunteer employees assist with and judge science fairs, give lectures, tutor, mentor, coach, and serve as classroom resource teachers. The program also sponsors African-American History Month art and essay contests for local schools, student tours of NRL, a student Toastmasters Youth Leadership Program, an annual holiday party for neighborhood children, and an annual book drive to support school libraries. Through this program NRL has active partnerships with four District of Columbia public schools. (Contact the Public Affairs Office at (202) 767-2541.)

- Other programs that enhance the development of NRL employees include four computer user groups (**IBM PC**, **Mac**, **NeXT**, and **Sun**). The **Amateur Radio Club** is devoted to amateur and related radio communications and is open to licensed radio operators as well as others interested in radio. The wide spectrum of club activities range from vintage radio to satellite communications. A club station is available for use by all members. The club conducts annual nationally coordinated Field Day (simulated emergency) operations. The **Recreation Club** accommodates the varied interests of NRL's employees with its numerous facilities, such as a 25-yard, 6-lane indoor swimming pool; basketball and volleyball courts; a weight room; an exercise room; table tennis; a meeting room; basketball leagues; hot tubs; saunas; and classes in five different types of martial arts, aerobics exercise, swimming, water aerobics, and water walking. The **Showboaters**, a nonprofit drama group that presents live theater for the enjoyment of NRL and the community, performs two major productions each year in addition to occasional performances at Laboratory functions and benefits for local charities. Though based at NRL, membership in Showboaters is not limited to NRL employees. 🏠

Programs for Non-NRL Employees

Several programs have been established for non-NRL employees. These programs encourage and support the participation of visiting scientists and engineers in research of interest to the Laboratory. Some of the programs may serve as stepping-stones to federal careers in science and technology. Their objective is to enhance the quality of the Laboratory's research activities through working associations and interchanges with highly capable scientists and engineers and to provide opportunities for outside scientists and engineers to work in the Navy laboratory environment. Along with enhancing the Laboratory's research, these programs acquaint participants with Navy capabilities and concerns.

Recent Ph.D., Faculty Member, and College Graduate Programs

- **The National Research Council (NRC)/NRL Cooperative Research Associateship Program** selects associates who conduct research at NRL in their chosen fields in collaboration with NRL scientists and engineers. The tenure period is two years.

- **The American Society for Engineering Education (ASEE) Postdoctoral Fellowship Program** aims to increase the involvement of highly trained scientists and engineers in disciplines necessary to meet the evolving needs of naval technology. Appointments are for one year (renewable for a second and sometimes a third year). These competitive appointments are made by ASEE.

- **The Consortium for Oceanographic Research and Education (CORE) Postdoctoral Fellowship Program.** Administered in much the same way as the other two, this program selects associates to conduct research in ocean and atmospheric sciences only. The aim is to recruit more scientists and engineers in these specialized areas.

- The American Society for Engineering Education also administers the **Navy/ASEE Summer Faculty Research Program** for university faculty members to work for ten weeks with professional peers in participating Navy laboratories on research of mutual interest.

- **The NRL/United States Naval Academy (USNA) Cooperative Program for Scientific Interchange** allows faculty members of the U.S. Naval Academy to participate in NRL research. This collaboration benefits the Academy by providing the opportunity for USNA faculty members to work on research of a more practical or applied nature. In turn, NRL's research program is strengthened by the available scientific and engineering expertise of the USNA faculty.

- **The National Defense Science and Engineering Graduate Fellowship Program** helps U.S.

citizens obtain advanced training in disciplines of science and engineering critical to the U.S. Navy. The three-year program awards fellowships to recent outstanding graduates to support their study and research leading to doctoral degrees in specified disciplines such as electrical engineering, computer sciences, material sciences, applied physics, and ocean engineering. Award recipients are encouraged to continue their study and research in a Navy laboratory during the summer.

For further information about these six programs, please contact (202) 404-7450.

- **The Professional Development Program for Ensigns** assigns newly commissioned ensigns who are awaiting future training to NRL, working in areas of their own choosing commensurate with their academic qualifications. These young officers provide a fruitful summer of research assistance while gaining valuable experience in the Navy's R&D program.

For more information, contact the Military Administrative Office at (202) 767-2103.

Professional Appointments

- **Faculty Member Appointments** use the special skills and abilities of faculty members for short periods to fill positions of a scientific, engineering, professional, or analytical nature.

- **Consultants and experts** are employed because they are outstanding in their fields of specialization, or because they possess ability of a rare nature and could not normally be employed as regular civil servants.

- **Intergovernmental Personnel Act Appointments** temporarily assign personnel from state or local government or an educational institution to the federal government (or vice versa) to improve public services rendered by all levels of government.

High School/Undergraduate/Graduate College Student Programs

The student programs are tailored to the undergraduate and graduate students to provide employment opportunities and work experience in naval research. These programs are designed to attract applicants for student and full professional employment in fields such as engineering, physics, mathematics, oceanography, meteorology, and computer science. The student employment programs are designed to help students and the educational institutions gain a better understanding of NRL's research, its challenges, and its opportunities. The employment programs for college students include the following:

- The **Student Career Experience Program** (formerly known as Cooperative Education Program) employs students in study-related occupations. The program is conducted in accordance with a planned schedule and a working agreement between NRL, the educational institution, and the student. Primary focus is on students pursuing bachelor degrees in engineering, computer science, or the physical sciences.

- The **Student Temporary Employment Program (STEP)** enables students to earn a salary while continuing their studies and offers them valuable work experience.

- The **Student Employment Program** employs students for the summer in paraprofessional and

technician positions in engineering, physical sciences, computer sciences, and mathematics.

- The **Student Volunteer Program** helps students gain valuable experience by allowing them to voluntarily perform educationally related work at NRL.

For additional information on these undergraduate and graduate student programs, contact (202) 767-8313.

High School Programs

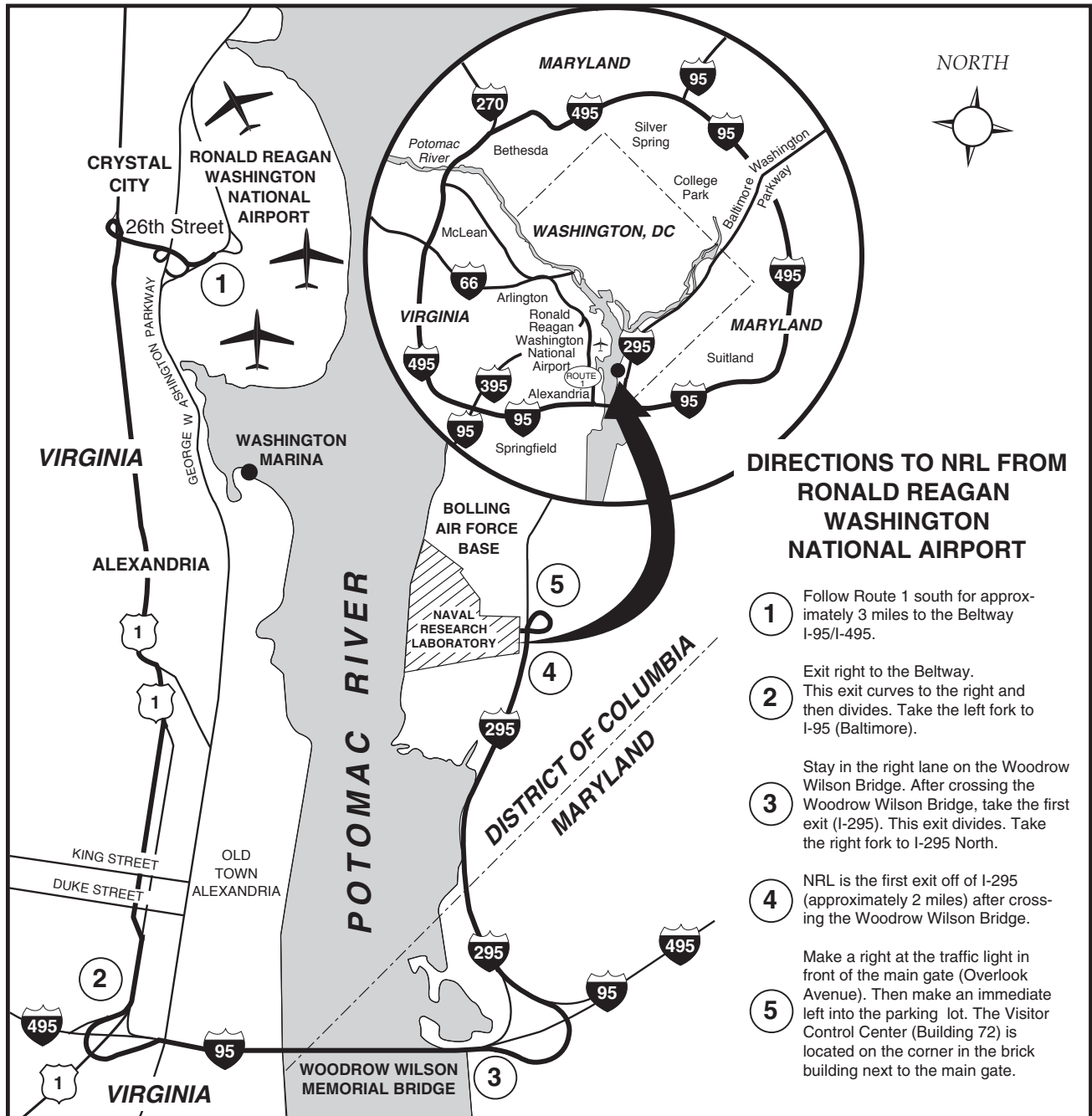
- The **DoD Science & Engineering Apprentice Program (SEAP)** employs high school juniors and seniors to serve for eight weeks as junior research associates. Under the direction of a mentor, students gain a better understanding of research, its challenges, and its opportunities through participation in scientific programs. Criteria for eligibility are based on science and mathematics courses completed and grades achieved; scientific motivation, curiosity, and capacity for sustained hard work; a desire for a technical career; teacher recommendations; and achievement test scores. The NRL program is the lead program and the largest in DoD.

Prospective mentors desiring additional information on this program, please contact (202) 767-2957.

Students desiring additional information on this program may call the George Washington University SEAP Coordinator's Office at (202) 994-2234.

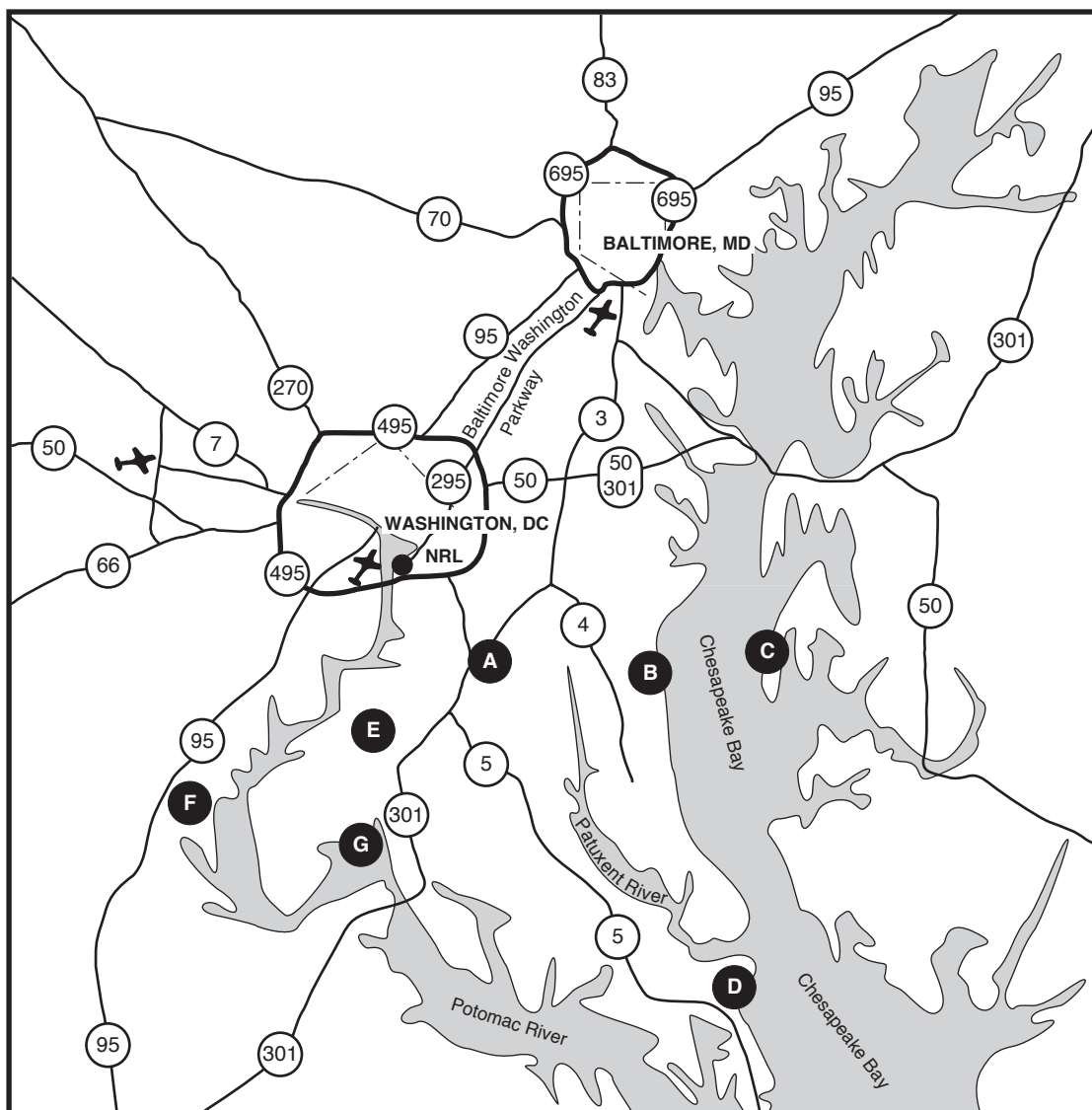
General Information

Naval Research Laboratory (Washington, DC)



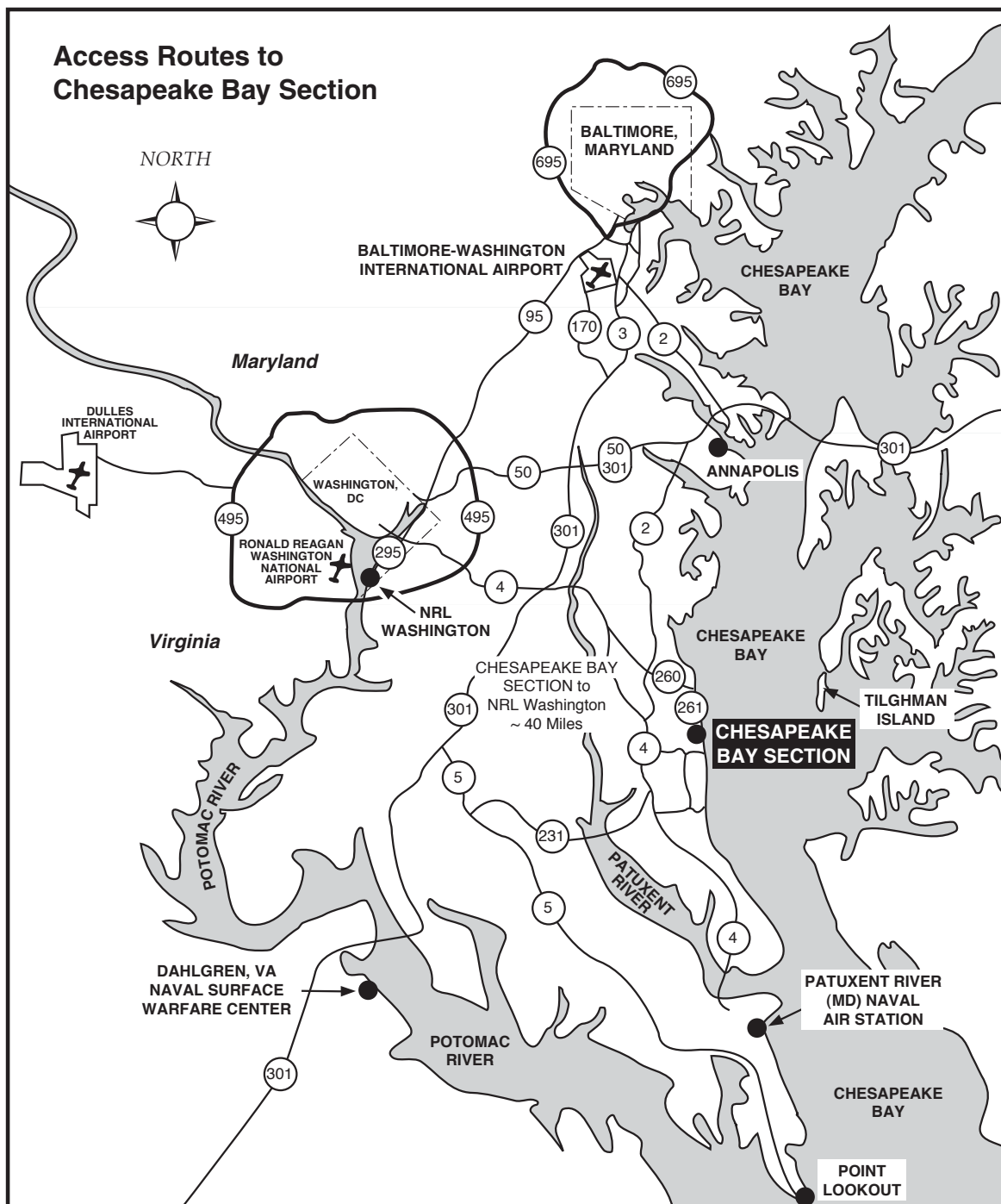
Naval Research Laboratory
4555 Overlook Avenue, SW
Washington, DC 20375-5320
(202) 767-3200 – DSN 297-3200

Location of Field Sites in the NRL Washington Area



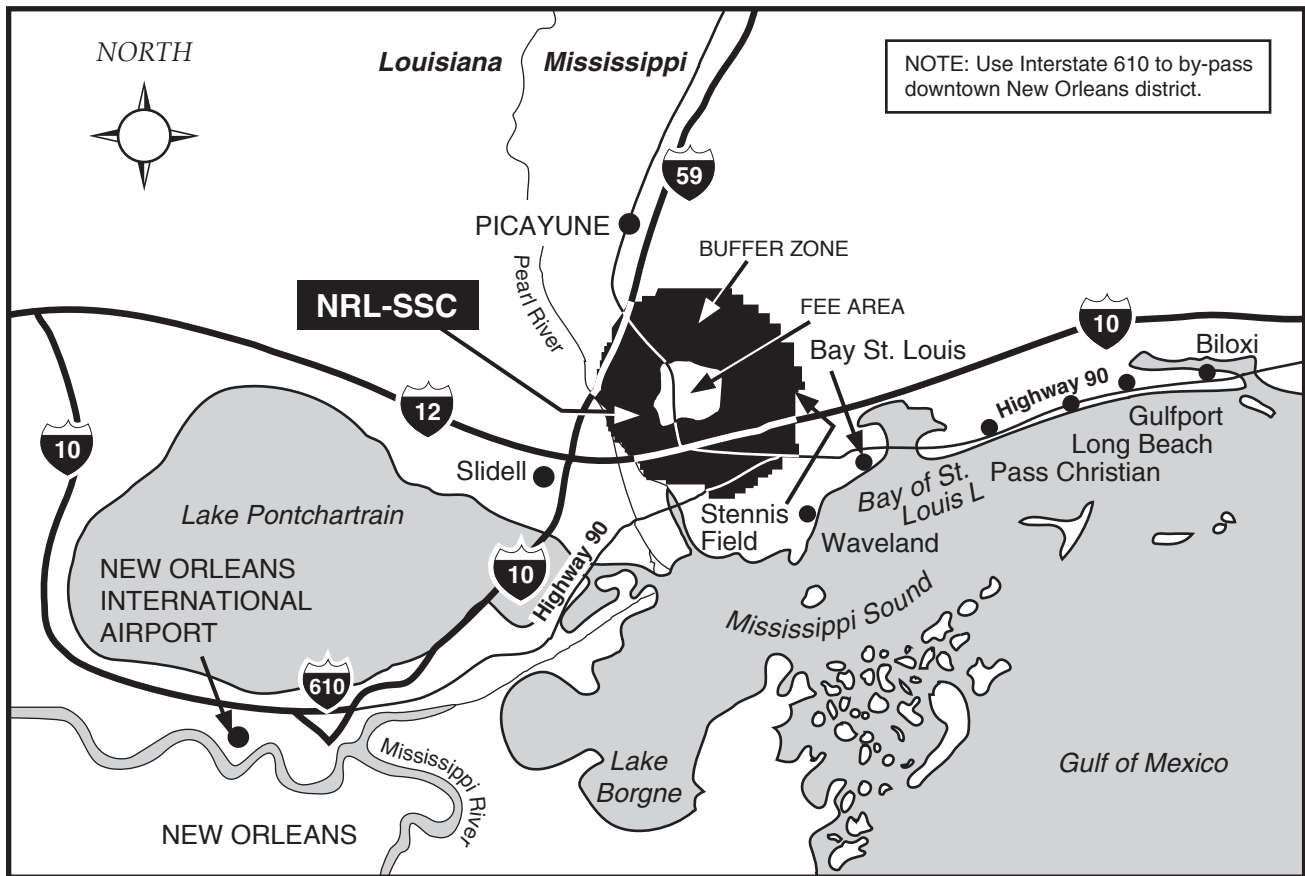
<u>Location</u>		<u>Approximate Mileage from NRL Washington</u>	<u>Cognizant Code</u>
A -	Brandywine, MD	28	5500
B -	Chesapeake Bay Section, Chesapeake Beach, MD	40	3522
C -	Tilghman Island, MD	110	3522
D -	Patuxent River (MD) Naval Air Station	64	1600
E -	Pomonkey, MD	20	8124
F -	Midway Research Center, Quantico, VA	38	8140
G -	Blossom Point, MD	40	8140

Chesapeake Bay Section (Chesapeake Beach, Maryland)



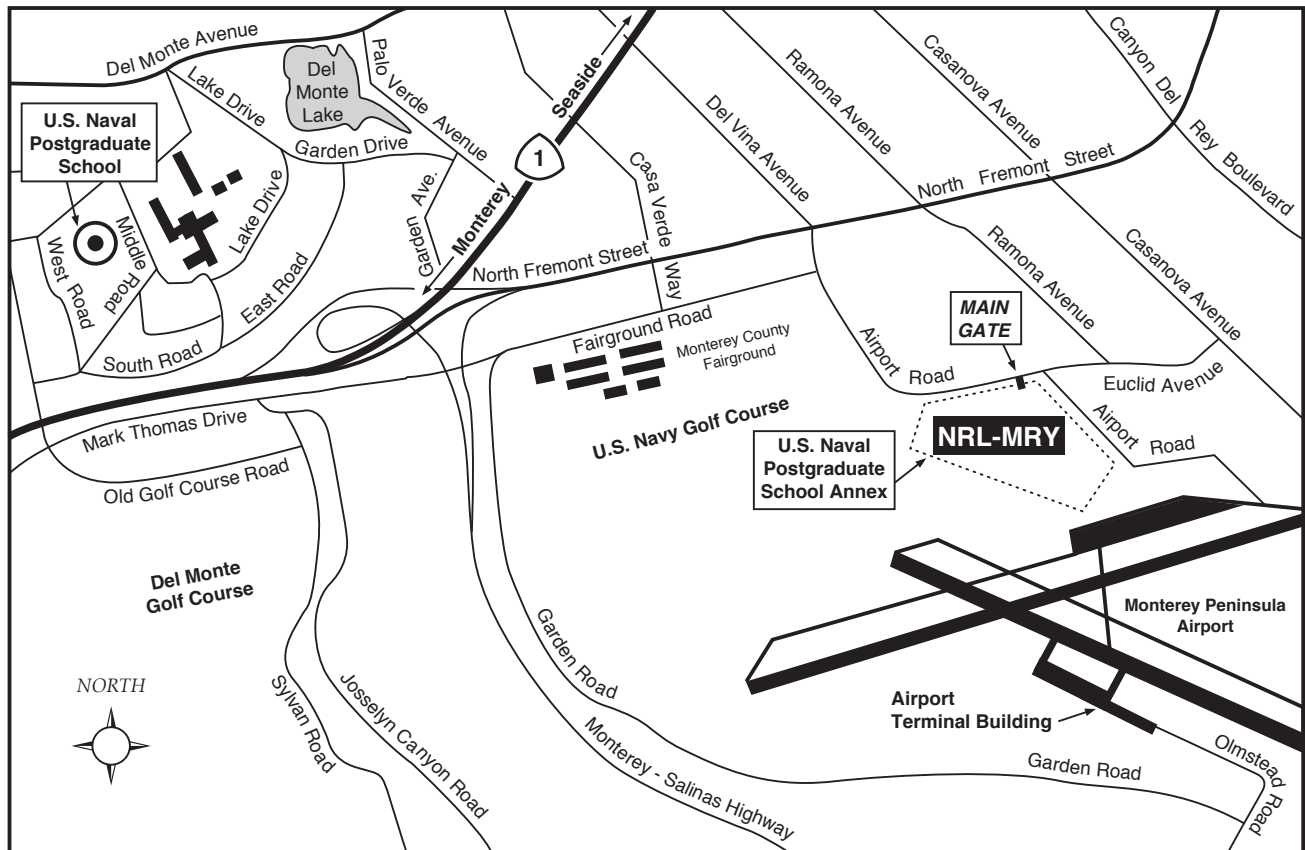
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The cooperation and assistance of others on the staffs of the Technical Information Services Branch and the Central Mail Processing Unit are also acknowledged and appreciated.

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December 2004

A handwritten signature in black ink, appearing to read 'DM Schubert', is written over the printed name.
David M. Schubert, Captain, USN
Commanding Officer

REFACT BOOK

<http://www.nrl.navy.mil>

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